Protection for a City Distribution System together with other engineering articles and the regular departments.


# Electrical World

New York, July 15, 1916 McGraw Publishing Co., Inc. Vol. 68, No. 3 10c a copy



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**Weston Electrical Instrument Co.**

# Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

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## J. Frank Morrison

IN his day and generation no man contributed more to the advance of the electrical industries than J. Frank Morrison, whose death last week is recorded elsewhere in our pages. Beginning as a telegrapher, he did notable pioneer work in telephony, and saw with swift intuition the illimitable opportunities in the central station field. No sooner had he entered that field as one of the chief representatives of the old Brush arc-lighting system, than he realized the fact that central stations must themselves have a central body of authority for information and reference. As far back as 1885, he, with the co-operation of George S. Bowen of Elgin, Ill., called the National Electric Light Association into existence, which was his greatest achievement in a long career of constructive work. He served as president of the association for no less than three years and left a deep imprint. He was one of the very first to see the possibilities of the electric motor, and the fact that he backed with all his fortune a series type of motor is not to his discredit in any way. That work with the Baxter motor did a great deal to give the modern central station its power load. Of late years Mr. Morrison had not been much in evidence, but his continuing interest in National Electric Light Association work was shown in his recent gift to the Baltimore Company Section of the gavel given him on resigning from the association presidency thirty years ago. The electrical industries have lost one more pioneer, a man whose force and driving power is embodied in real achievement, while his ability of expression remains crystallized in his immortal definition of alternating current.

## Limiting Free Consulting Service

IN the average college town the professor of electrical engineering is looked upon by the town and by the surrounding community as the free consultant in electricity. If the municipality is considering a new pumping station the advice of the professor is sought as to type of motor or method of driving; if some local enthusiast decides he would like to set his clock by wireless, he asks for a list of equipment, how high to make the aerial and so on. A certain number of questions make good laboratory problems for the students, and one professor, at least, has made it a practice to turn the questions over to them. But many of the problems are either too formal or too special to be handled in this way. The call for free service is found particularly in State institutions in which the authorities, and even the taxpayers, assume that what they ask for is quite legitimate. In handling the serious problems of this consulting work, the engineer feels bound to render assistance in pointing out how the work can be done, and to explain in some detail the principles involved. It is equally just, however, for him to draw the line on this free service at the point where it demands special investigation and research, and to frankly state as much in a preliminary report. He may then be asked to carry on the work as a consultant on the same basis as any engineer. Many professors, of course, are established in special consulting work for manufacturers, central stations and municipalities. For them the handling of requests for free service is often professionally more difficult. Discrimination between advice and special service, however, will generally result in a satisfactory adjustment. Certain it is that special service should not be free, and that the professor of electrical engineering, acting as a consultant, is entitled to regular fees for his work.

## Central Station Power for Railway Work

AN interview with John F. Wallace on another page points out the undoubted tendency of railroad companies to purchase energy from central station plants. While definite figures are difficult to secure, owing to the interrelation of the railway and lighting utilities in some cities and towns, it is fair to state that approximately 50 per cent of the electric railways are operated from central station energy. H. G. Stott, speaking before the Connecticut Company Section of the American Electric Railway Association, pointed out that the main consideration in the final determination of whether the electric railway should generate or purchase power, centers in load factor conditions. The flatter the load curve, of course, the cheaper the power. This is the main incentive for the general power company, said Mr. Stott, to get loads from all sources, various kinds of loads and especially night loads. If the railway can build up a load factor as good as the power company can, then there is no reason why the railway company should not make its own energy. If the power company can build up a better load factor than the railway company can for any reason, then the power company can make energy cheaper than the railway. Owing to franchise conditions, however, the railway company can rarely improve its load factor; because it has not the right to sell energy to others. The power company, on the other hand, can sell to anyone, including the railway company, and therefore can acquire a much better load factor. Moreover, it is the function of a railway company to sell transportation, and of a power company to sell energy, and all wise railway men usually recognize the distinction.

## Study in Lightning Protection

MR. ROPER'S report of the lightning protection investigation made by the Commonwealth Edison Company of Chicago, as presented at the recent A.I.E.E. convention and abstracted in this issue, is one of the most important contributions on a very difficult subject which has appeared in many years. The experiments carried out were on so extensive a scale that it is almost unfair to refer to them as experiments at all. They were rather practical trials of well-considered theories on a large scale based on observation and experience and worked out as part of the service of the company. Above everything else in the work of a public service corporation stands reliability, and it is the full appreciation of this factor which gives particular importance to the lightning arrester studies in Chicago. The system on which the trials were made is particularly well fitted to disclose the whole truth. The circuits were four-wire, three-phase with neutral and 4000 volts between the phase wires. A voltage of this magnitude is particularly well adapted to disclose lightning troubles, since it is high enough to furnish somewhat formidable voltages in case of surging and the currents transmitted at this pressure are big enough to stir no small amount of electromagnetic energy. Looking at the matter broadly the first practical disclosure of the Chicago experience was the weak spot in the transformer installation, which proved to be the primary terminal board. As a matter of experience it was found that this was the usual seat of the arcing in case of lightning. The scheme of lightning protection previously used included a reasonable number of arresters distributed over the lines, and this arrangement was not changed prior to the elimination of 250 terminal boards from a single circuit. A favorable result was very soon in evidence, and on the theory that the best place to put a lightning arrester is where lightning is likely to do the most damage, circuits were selected on which every transformer was protected by an arrester on the same pole. Thus not only was the number of arresters greatly increased, but each was put where it was believed that it would do the most good. The new arrangement disclosed remarkable immunity from lightning, and so the experiments went on, circuit by circuit, each one equipped with a different type of arrester, until some 1600 transformers were included in the test area.

The results following this were alone more decisive than at first, showing that the removal of the terminal boards would get rid of about 60 per cent of the lightning troubles, and that the installation of lightning arresters on poles with the transformers made a considerable further reduction. These results of themselves were of very great importance in securing continuity of service and decreasing the number of injured transformers. There has also been current a theory that grounding the transformer case afforded a certain protection against lightning, and this was tried out with 600 transformers in circuits protected by arresters on the same poles. Experience over a period of three years showed that, if anything, grounding the case was detrimental rather than helpful, a result rather in keeping with general theory, which would indicate that when an easy path to earth is furnished by a local lightning arrester, protection would certainly not be improved by tempting the stroke to make its way to the case.

Further trials were made by considerably increasing the number of arresters above that required for the transformer poles. The areas thus tried out last year provided an amount of carefully placed lightning protection altogether unique in the history of distribution systems. The results were remarkably good, and it was found in addition that in the areas most thoroughly protected the decrease of the troubles from lightning seemed to be disproportionately great, as compared with circuits on which there were merely transformers protected by arresters on the same pole. The general figures indicate that, with the terminal boards removed and one arrester per transformer, the amount of trouble from lightning on circuits would be reduced about 50 per cent if these arresters were on the transformer poles rather than outside on the line. It seems to be plainly indicated that the density, so to speak, of the arresters per mile of circuit was a rather important factor in securing protection, although it was clear that the mere installation on the transformer pole does not give perfect protection. This is really what might have been anticipated, since every chance for lightning to make its way harmless to earth via an arrester lessens the probability of a considerable amount of energy reaching a transformer.

It has been observed in cases when lightning strikes an overhead line in a region where there are no transformers it often manifests destructive effects at a single point, with perhaps reduced damage done at every pole in each direction from the center of the disturbance until the discharge within a few hundred yards seems to be dissipated by the relief given it to earth in the interval. In a line protected by frequent lightning arresters this diverting of energy from the point actually struck should be very rapid, as the Chicago experiments seem to indicate. After all, it is merely a question of relieving the line from a tremendous influx of energy in the quickest and most harmless way possible. And this can be done by installing enough arresters to make it unlikely on the mere theory of probabilities that a flash will strike the line where there is no arrester between it and the transformer. This, too, is the reason for the success of installing transformers at the transformer poles—in other words, protecting the transformer at a very near point. Fortunately, modern line transformers are reasonably reliable and increasing their numbers does not materially increase the chance of trouble from the arresters themselves. It looks very much as though the intelligent persistence of the Commonwealth Edison Company in working out the details of protecting its circuits against lightning has not only done an immense service to the art of reliable and continuous distribution of electrical energy, but shown other companies how thousands of dollars can be annually saved.

## Lighting a Moving Picture Theater

THEATER lighting, as such, is rather an art by itself on account of the special problems involved in scenic effects. The moving picture theater might be supposed at first thought to be a simple matter, yet in fact it has intricacies quite its own. The article on the lighting of such a theater in Milwaukee, of which the first portion is published in this issue, gives an excellent notion both of the requirements that have to be met and the downright engineering skill that is required to produce the desired results. Broadly, the problem is that of adequately lighting an auditorium which must never be very brilliant, save during intermissions, and must be so subdued as neither to detract from the effectiveness of the pictures upon the screen nor in any way to reach the eyes of the audience in such manner as to interfere in any way with their comfort.

The main characteristic of the illumination of this particular theater is the complete absence of any visible lighting units. The whole scheme is carried out by indirect lighting, so that there is never a spot of high intrinsic brilliancy to annoy the eye, yet always enough light to give an agreeable effect to the interior and to leave sufficient contrast to make the pictures easily and comfortably visible. The lobby is an example chiefly of cove lighting with reflectors concealed in the cornice along the side walls, each panel of the ceiling having four of these lighting units. The general scheme followed was to gradually decrease the intensity of the illumination from a brilliant and attractive entrance down to the moderate light of the auditorium. The foyer is lighted also by indirect units arranged in the customary bowl fixtures. This opens into the auditorium under the balcony. At this point the lighting problem is ingeniously solved by decorative glass skylights in the bottom of the balcony, the recesses above each skylight being painted white and containing the necessary number of lamps. It is in the auditorium, however, that the most ingenious application of indirect lighting has been made. It consists in a series of concentrating reflectors set high up in the walls so as to throw the light almost horizontally along the ceiling. The angle of reflection and of incidence is chosen so that the main body of light reaches out to the more distant parts of the ceiling near its middle line, thus producing an unusual degree of uniformity.

A feature of this particular system is that three sets of lights are used, a low intensity in yellowish white, which is ordinarily employed during the projection of the pictures; a low, intensely bluish light used when night scenes are on to make the whole interior effect harmonize, and finally a higher intensity of white light used when the screen is not at work. Enough has been said to show the novelty and effectiveness of the methods employed.

## Electricity in the Field

IT would be interesting to know what steps have been taken to secure the necessary electrical equipment for even the meager forces that the United States now has on the Mexican frontier. From all the accounts that have reached us from that territory the field wireless apparatus has been rather consistently out of order, and most of the communications have had to be established by old-fashioned methods. Is it not time for the War Department to come to the "right about face" and look forward; to prepare for emergencies which are looming up, and to try to obtain necessary equipment at least a year before, instead of a year after, it is acutely needed? The European services have developed light, portable wireless equipment with an easy range of from 20 to 50 miles, and light enough, in fact, to be carried on the aeroplanes. They also have field sets of far greater radius, and still readily transportable. Unless all reports are entirely unreliable General Pershing is not blessed with anything of this sort. If our troops, or any of them, are to act in a strictly defensive campaign along the boundary they need ample equipment of this kind, as well as portable searchlights for disclosing hostile operations and directing night firing upon them. If anything has been done to provide these, except the small experimental equipment, we have yet to learn of it.

Modern equipment for wireless like the country's supply of machine guns and heavy field howitzers, is *non ester,* as Artemus Ward used to say. Electrical equipment is really much more quickly and readily obtained than ordnance equipment. It can be turned out on very short notice, but it cannot be delivered day before yesterday, and if the army authorities pursue the policy of watchful waiting to see whether they are really going to need it after all, they are liable to get the goods they require somewhere about the beginning of next year. We offer here no criticism on the technical branches of the service. They have struggled and besought for years in vain, but nothing too harsh can be said of the dismal penuriousness and inefficiency which has prevented the supply of an adequate amount of first-class material in reserve to meet the technical requirements of a modern campaign.

### The Coming Issues

NEXT week an article on a phase of city lighting will be presented which, together with a discussion of business policy by a well-known manufacturer, mark the broad commercial side of the issue. An interesting engineering article on the conditions under which an Oregon central station burns wood will also be presented. The interviews with representative men on subjects of timely interest will be continued through the coming issues. In the department which is regularly devoted to "Advance in Technical Theory and Practice" arrangements have been made to record more fully the developments in radiotelegraphy and radiotelephony, and these subjects will be given special treatment in early issues. Next week will appear the first issue of ELECTRICAL MERCHANDISING, which extends to the trade the editorial service of the ELECTRICAL WORLD.

Chronicle of Events of the Industry and of Important Movements in the Field

# NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

## PACIFIC GAS & ELECTRIC TO PROTECT SECURITY HOLDERS

### The Company Is to Set Aside $7,000,000 in the Next Seven Years Out of Income—The Fund Is to Be Uncapitalized

As a result of the agreement reached between the Pacific Gas & Electric Company and the California Railroad Commission, the commission has issued an order by which the company will set aside $7,000,000 in the next seven years out of income to conserve its assets and protect its security holders. Of this sum $800,000 will be set aside in 1916, $1,000,000 in 1917, and each year thereafter until 1922, when $1,200,000 will be set aside. The funds so set aside are to remain uncapitalized, and it is provided that the company shall have the right to apply against these payments all sums paid into the sinking funds.

Vice-President John A. Britton of the company, in commenting on the order, said that it showed that after all earnings in litigation had been excluded, and all charges of every kind made, including dividends on preferred and common stocks, the company is earning a surplus of $1,200,000 a year. As this is $400,000 in excess of the $800,000 obligation imposed by the commission, Mr. Britton says that this should show that the 5 per cent dividend rate on the common stock is assured beyond any question.

In regard to the future Mr. Britton says: "As this obligation after 1916 will be increased by but $200,000 a year, and the income of the company applicable to dividends has been growing at the rate of something like $1,000,000 a year for the last three years, the company should have no trouble whatever in continuing the present disbursements on its common stock in addition to putting a substantial part of its earnings into the property, which also will be for the benefit of the stockholders."

The commission announced that the issuing of this order is not to be construed as any criticism of the dividend policy of the company. Last spring the commission criticised the company quite severely in an order denying authority to issue $1,021,000 common stock as a 3 per cent stock dividend. The stocks of the company declined sharply in consequence, as the action of the commission was taken as a criticism on the dividend policy of the company, which has just announced the placing of the common stock on a 5 per cent cash basis.

In denying the application to pay a stock dividend the commission advised the company that unless it adopted a policy of conserving its revenues and assets the commission would inaugurate an investigation of its affairs. Attention was called to the fact that the company in marketing its new 6 per cent preferred stock called special attention to the fact that the issue of this stock was approved by the commission, and says: "This company should not adopt a policy that cannot fail to impair the position of these investors."

In referring to the danger of impairing the position of those who have invested in the company's preferred stock, the ruling went on to say that the condition "is emphasized by the evidence and the practical admission of the company that its depreciation reserves have been inadequate. At the time when it is clear that revenues should be conserved against this depreciation, and to build up assets, it is proposed to distribute these revenues to the holders of the common stock."

In connection with the order of the commission authorizing the $7,000,000 fund it must be remembered that by refraining from capitalizing its sinking fund payments the company in the next seven years will retire something like $7,000,000 of its bonds from earnings, which will mean a saving in interest charges running from $40,000 in the present year to $350,000 in 1922.

## National Electrical Contractors' Association

Arrangements have been completed for the sixteenth annual convention of the National Electrical Contractors' Association of the United States, to be held next week at the Hotel McAlpin, New York City. The convention will open on Wednesday morning, July 19, and continue throughout the week. It is estimated from the number of reservations made early this week that between 300 and 400 contractors will attend. Prior to the opening of the convention the National Executive Committee will hold a meeting on Monday morning, and the National Board of Directors will meet on Tuesday morning.

The first session is scheduled for Wednesday morning at 10 A. M., and is open to all. Lewis H. Woods, president of the New York State Association, will deliver the address of welcome, to which response will be made by John R. Galloway, president of the national body. Addresses will be made by Mayor Mitchel of New York City; James H. McGraw, president McGraw Publishing Company, whose subject will be "Electrical Merchandising"; T. C. Martin, secretary National Electric Light Association; Arthur Williams, New York Edison Company; J. M. Wakeman, general manager Society for Electrical Development. It is also expected that the traveling secretary of the United States Chamber of Commerce will be present during the session to talk to the members about the activities of his organization.

The business session on Wednesday afternoon will be open to members only. The first of the many entertainment features will be a reception and dance to be held on Wednesday evening.

With a view of interesting electrical contractors who are not members of the National Electrical Contractors' Association, the executive committee has decided to invite all electrical contractors to attend the morning business session on July 20, at which time two very interesting reports will be presented. The first of these is that of Joseph A. Fowler of Memphis, Tenn., chairman of the insurance committee, on the national plans for joint liability and compensation insurance, whereby a large saving in insurance premiums is effected for members. His report will be supplemented by an address by L. T. Block, manager of the Utilities Indemnity Exchange of St. Louis. The other report will be presented by E. McCleary of Detroit, chairman of the national electrical code committee, who will give data on the code and also designate someone to give the latest data regarding the much discussed "concentric wiring." Discussions on these subjects by members and non-member contractors will follow.

The business sessions of Thursday afternoon and Friday morning, however, will be open to members only. Organization meetings of the board of directors and of the executive committee on Saturday morning conclude the business program.

### ENTERTAINMENT FEATURES

In addition to the reception and dance to be held in the blue and green rooms of the hotel on Wednesday evening, a number of other amusements have been arranged for the entertainment of the visiting members and ladies. A shopping tour has been planned for the ladies for Thursday morning, and in the afternoon a complimentary concert will be tendered to ladies and guests by the Aeolian Company at Aeolian Hall, on Forty-second Street.

Thursday afternoon and evening will be spent at Hotel Trouville, Long Beach, Long Island, a special train leaving the Pennsylvania Station at 3 P. M. At the beach there will be various forms of amusement, including surf bathing and a dinner dance and entertainment. A final excursion will be held on Saturday, when the "Seeing New York by Water" trip will be taken.

During convention week an electrical exhibit will be held under the management of the Hotel McAlpin in the Terra Cotta Room of the hotel. In all there will be about 100 exhibitors.

## Milwaukee Creates Bureau of Illumination Service and Retains Consulting Engineer

In order to carry on the construction, operation and maintenance of its new street lighting system, the City Council of Milwaukee has passed an ordinance creating a sub-department or bureau of the department of public works. The new bureau is to be known as the bureau of illumination service, and is to be organized in two divisions—the division of illuminating engineering and the division of construction and maintenance. The division of illuminating engineering is to have charge of the character, type, size, location, design and routing of all electrical and gas equipment comprised in the street lighting system, and also of the electrical and photometric laboratory for which $4,000 has been appropriated from the 1916 budget. The division of construction and maintenance is to have charge of all construction, inspection, and maintenance and repair work of all lighting circuits, fixtures, posts, lamps, etc., owned and maintained by the city of Milwaukee.

The bureau of illumination service is placed under the immediate direction of the commissioner of public works, F. G. Simmons, who has appointed F. A. Vaughn, of Vaughn, Meyer & Sweet, Milwaukee, as consulting engineer for the installation. Mr. Vaughn is retained on a basis of $10,000 per year, and the term of employment is to be approximately six months.

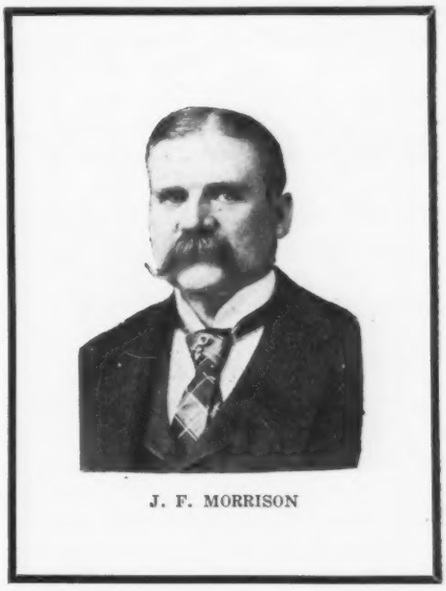
The ordinance also creates the following positions in the bureau of illumination service, appointments to which are to be made by the commissioner of public works as soon as competent men can be found: engineer in charge of the division of illuminating engineering at an annual salary of $2,100, and three assistant engineers at salaries of $960, $840 and $720 respectively; engineer in charge of the division of construction and maintenance at an annual salary of $2,400, and an electrician and electrical assistant in the same division at salaries of $1,200 and $900 respectively. The sum of $5,500 was appropriated from the 1916 budget for the payment of salaries during the current year for the positions created.

## J. F. MORRISON DEAD

### First President of the National Electric Light Association Passes Away in His Home in Baltimore, After a Lingering Illness

We have been advised by President H. L. Wagner of the National Electric Light Association that James Frank Morrison, the first president of the National Electric Light Association, passed away at his home in Baltimore last week. He had been suffering for some time from cancer of the tongue, his sickness leading him recently to almost complete seclusion.

J. F. Morrison was born on April 18, 1841, at St. John's, New Brunswick. Leaving his Canadian home at the age of fifteen years, with only such education as had been imparted by a tutor, he went to Boston, and took a position in a business house. He went to Baltimore in 1862, at the age of twenty-one, and began his



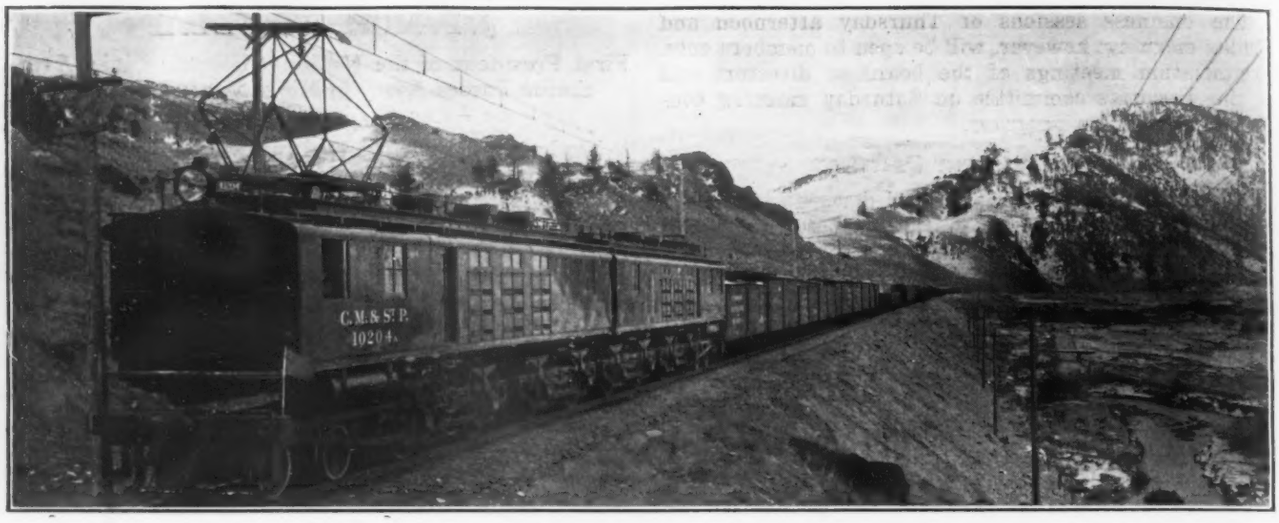
J. F. MORRISON

electrical career by entering the telegraph service of the Baltimore and Ohio Railroad Company. From that time until 1878 Mr. Morrison held various electrical positions, including that of night manager of the Western Union Telegraph Company, and in that year he built a long-distance telephone line, extending from Georgetown, near Washington, along the Chesapeake and Ohio Canal to Cumberland, a distance of over 200 miles.

In 1880 Mr. Morrison organized the pioneer Brush Company for the supply of local electric arc lighting, which built in Baltimore one of the first real central electric light stations in the country. The only previous station in the country was the Brush plant installed in some old buildings on Twenty-third Street, New York City.

Mr. Morrison was instrumental in the invention, in 1887, by the late William Baxter, Jr., of the original Baxter series motor, when only series service was available. He established a factory for its manufacture and displayed great energy in its introduction.

Mr. Morrison also organized the Southern Electric Company. His mastery of the electrical field was recognized and evidenced by his election as first president of the National Electric Light Association, at the time of its first convention in Chicago, in 1885. He held the office for three years. Resolutions of appreciation and respect in recognition of Mr. Morrison's great pioneer work were presented at Chicago in May. They were adopted by the association, and sent immediately to Baltimore.




ECONOMY WAS THE MOTIVE IN THE LARGEST RECENT INSTALLATION, THAT OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY, WHICH BUYS ENERGY FROM THE MONTANA POWER COMPANY

# Railroads Will Demand Central Station Energy

## Tendency Will Be Toward the Purchase of Power from Corporations Generating Energy on a Large Scale, Says John F. Wallace—Conditions in Chicago

NINTH IN A SERIES OF "TALKS IN THE INDUSTRY"

BY FREDERIC NICHOLAS

*John F. Wallace, who has given an interview to* the ELECTRICAL WORLD *pointing to the use of central station energy in future railroad electrification work, is president of Westinghouse Church Kerr & Company. As chairman of the Chicago Railway Terminal Commission he is making a comprehensive investigation of the practicability of electrification of the carriers which have extensive terminals in that great traffic center. Mr. Wallace recommends that operators of large central station companies so plan extensions as to make them available at least expense for future power requirements of the railroads.*

"IN future electrification developments," said Mr. Wallace, "the tendency will undoubtedly be definitely toward the purchase by the railroad companies of energy from public service corporations engaged in the generation of energy on a large scale rather than toward the installation of independent power plants."

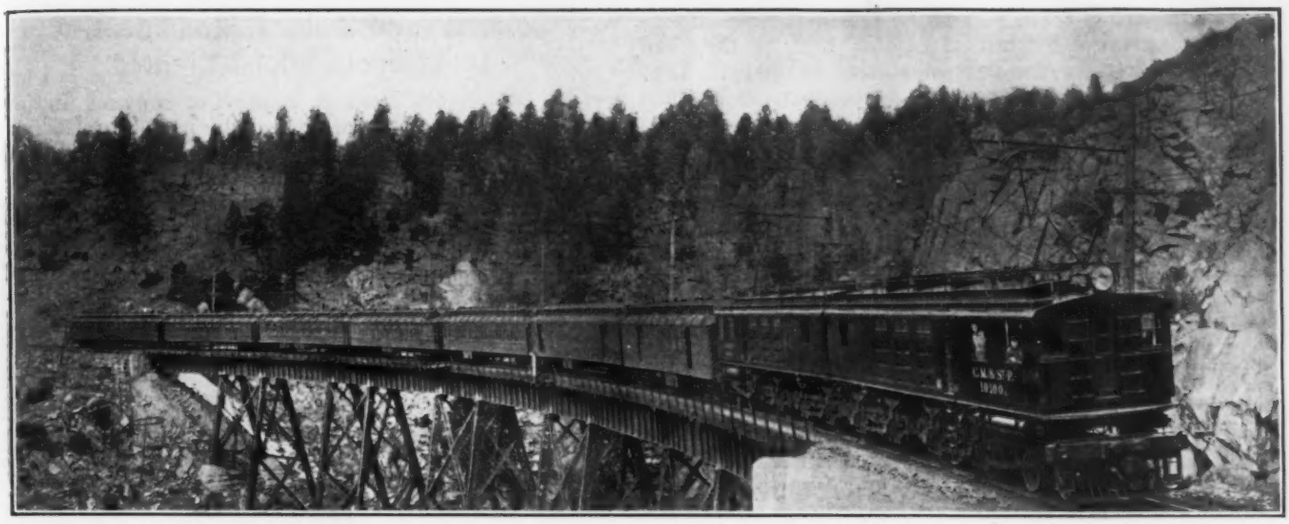
Mr. Wallace made his first studies of the possibilities of electrification in 1892-1893, when he was chief engineer of the Illinois Central Railroad, in connection with the preparations of that company for handling the World's Fair traffic in 1893. "The problem then," he said, "was not only to provide for the World's Fair temporary business, but also to develop a system that would be applicable afterward to the permanent terminal traffic problems. It was felt that the necessary large expenditure for electrification would be unwarranted unless the system should be usable at the expiration of the fair for the terminal as it would exist under normal conditions. Our investigation was most thorough, but we were placed at a disadvantage by the fact that at that time electric traction had not progressed beyond application to street railway service or, at best, short-distance interurban service. We discussed the problems of our service with the representatives of the leading manufacturing companies, but in all of our studies we were confronted by the obstacle that electricity had not then been applied to heavy units of transportation, such as eight to twelve-car trains with a carrying capacity of 1000 persons.

### CHICAGO THEN AND NOW

"In those early years there was no apparatus or station for the generation of electrical energy on a large scale. Chicago did not then have a plant capable of furnishing the required energy, and in our tentative plans we were therefore under the necessity of including the consideration of an independent station. By way of comparison it is interesting to note that to-day the Commonwealth Edison Company has sufficient available surplus capacity to supply energy for the electric operation of the terminal zone of any one of the railroad systems entering Chicago, although it would, of course, have to install additional apparatus if it were called upon to meet the enormous requirements of all of the roads in that center.

"The thorough consideration of the subject of electrification which was given in those early years disclosed so many uncertainties, both as to the ultimate cost and the operating details affecting trains as well as electrical plant, that it was finally decided to be inadvisable to substitute electricity for this service. However, after the close of the World's Fair a permanent committee, of which I was chairman, was formed with an engineering secretary for the purpose of watching the progress of electrical installations and reporting to the company from time to time should conditions change so as to make electrification desirable."

This committee was discontinued when Mr. Wallace left the service of the Illinois Central Railroad in 1904. On account of the various problems concerned and the fact that the subject has been considered entirely from the standpoint of financial and commercial results the Illinois Central company has not yet electrified its service. "At the present time, however," added Mr. Wallace, "investigations are under way looking to this end, and it is probable that this serious consideration will



THE USE OF CENTRAL-STATION ENERGY REDUCES THE INVESTMENT REQUIRED BY THE RAILWAY AND PUBLIC SERVICE CORPORATIONS SHOULD PREPARE TO MEET LARGE DEMANDS IN THE FUTURE

lead to the beginning of electric operation within a few years."

### COST OF COMPREHENSIVE ELECTRIFICATION IN CHICAGO

Mr. Wallace emphasized the fact that the report made to the city of Chicago by the Chicago Association of Commerce in November, 1915, was based on an investigation which followed very different lines from the one that is now under way. The investigation, which was conducted by the Association of Commerce, lasted for four or five years, and cost $600,000, which was paid by the railroads. It was undertaken primarily because of agitation for the abatement of smoke, and it included a detailed estimate of the practicability and cost of electrification of all of the steam roads entering Chicago. The conclusions were adverse to the general and complete electrification of all of the steam roads, including suburban, regular passenger, freight and switching service.

"However," Mr. Wallace points out, "these conclusions were based on the grounds that the investigation showed that only a small part of the smoke and cinders in the city were due to railroad operation, and that the cost of comprehensive electrification of all classes of service within the city limits would be so large that from the standpoint of the elimination of smoke and cinders it was not reasonable to require the railroads to spend the enormous sum estimated as necessary."

The estimated cost, including electrification and betterments precipitated thereby, was $274,000,000. In its report the commission figured on the expense of constructing an independent generating plant, though this was done apparently to make the estimate complete, as the commission stated that it would expressly refrain from any comparison or decision on the question of purchased energy versus energy produced by the railroads themselves.

As the conclusions of this report were not satisfactory to the City Council the question was refered to the Chicago Railway Terminal Commission, of which Mr. Wallace is chairman.

"In connection with the work of this commission," Mr. Wallace continued, "I have given considerable attention to the electrification of the Illinois Central terminal and the associated problems.

"The scope of the investigation has so broadened, however, that it now includes the consideration of the electrification of the suburban service of the other roads entering Chicago.

"Probably the solution of the problem will be a gradual one, and will be reached by first the complete electrification of the Illinois Central suburban service, followed by the suburban service of the other roads as the conditions of their operation justify.

### SETTLE THE QUESTION OF ECONOMY

"Whether electrified suburban or terminal service offers any advantage in economy, as compared with steam, has not been demonstrated conclusively. It is important that this question shall be answered. The principal advantage which has been demonstrated up to this time for suburban and terminal electrification is the elimination of smoke and cinders. However, there are train operating advantages which appeal to the steam roads, the largest one being the reduction of excessive track use and switching service at stub-end passenger stations. This reduction of train movements is understood to have been the main factor which led the Pennsylvania Railroad to electrify the Philadelphia terminal, using the multiple-unit system.

"Electrification is highly advantageous for reasons of safety where operation through tunnels is necessary, as there is a danger that signals will be misunderstood when steam and the fouling of the atmosphere make white lights look red. This was the chief motive underlying the New York Central-New York, New Haven & Hartford electrification. After a start has been made with strictly terminal electrification the tendency, as in the case of those two roads, is to extend the improvement out some distance on the main line so as to lengthen the run and exclude short steam locomotive runs. This materially increases the power requirements.

"Another class of a highly desirable electrification project is illustrated by the mountain division of the Chicago, Milwaukee & St. Paul Railway. This is plainly attributable to economy, as the company buys its energy at a very low rate and is able to introduce operating advantages which conserve its requirements of power and lessen the number of its train crews.

### DECREASE IN GENERATING COST

"One of the strongest arguments which is steadily promoting electrification is the continual decrease in the cost of generating electrical energy. The first reason for this is the development of large steam producing units, but other factors are also working in this direction. The remarkable development which has taken place in the reduction of cost makes it probable that when the day of electrification in Chicago arrives, the

steam railroads there will be able to avoid the investment of a large amount of capital, because they can buy energy from the central station company. That company has reached the acme of economy in its production of electrical energy.

PREPAREDNESS OF DESIGN WILL CONSERVE CAPITAL

"It would be well for large central station companies to continue to study the possibilities in this direction with great care. In planning future power-house construction they can then provide for expansion to enable them to meet the demand for such additional business as may be available. Such companies should be able so to make their plans that they would not require much, if any, capital outlay above what they would make under the normal conditions of growth in their communities. They can introduce a definite element of preparedness into their designs and construction that will conserve capital expenditure and save time if they are called upon in the future to provide for great railway electrification projects.

PROGRESS WILL BE RAPID

"It is entirely reasonable to look for further improvements in the art which will operate in the future to reduce the cost of electric power for railroad operation as compared with the cost of power in individual steam locomotive units. It is impossible to predict the day when railroads will demand large amounts of energy from central station companies. The development of the art, negotiations between the railroads and the communities which they serve, and the financial condition of the railroads all contribute toward the final solution of the problem. That there will be progress, and that it will be rapid, is predicted by all of the signs of the times."

## Patent Granted for Air Blast Alternating Current Rectifier

A very simple and ingenious method of rectifying high-tension alternating-currents by means of an air blast has been assigned to the International Precipitation Company of Los Angeles, Cal., under U. S. Patent 1,188,597. Wolcott and Rieber proposed to surround a rod electrode, spaced from a co-operating disk electrode, with an air blast at a pressure of about 10 lb. to the

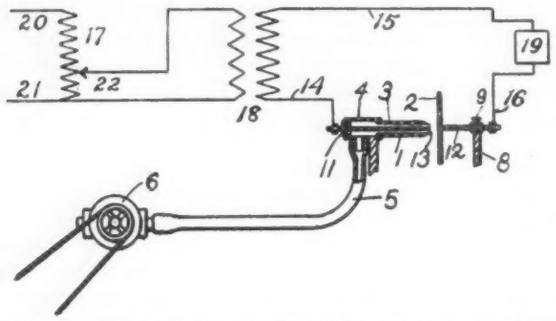


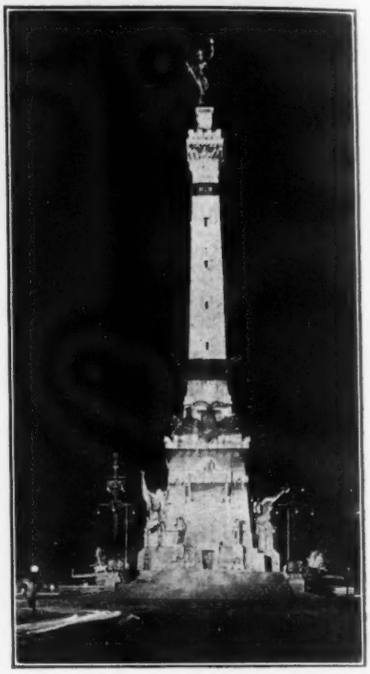

DIAGRAM OF AIR BLAST ALTERNATING CURRENT RECTIFIER

square inch. By directing the air blast along the path of the discharge, the inventors maintain, that an alternating-current of as much as 50,000 volts can be wholly rectified.

It is also found, the inventors state, that by regulating the air pressure it is possible to secure any desired amount of rectification. It also becomes possible to rectify both halves of an alternating-current wave and obviate entirely all expensive equipment of vacuum tubes, etc.

## Soldiers' and Sailors' Monument at Indianapolis Flood-Lighted

The Merchants Heat & Light Company of Indianapolis, Ind., last week presented the people of Hoosierdom's capital city with one of the most beautiful flood-lighting spectacles thus far completed, when on July 4 the beams of 100 projectors were turned on the Soldiers' and Sailors' Monument. Standing in the Circle about which the city is built, and from which the principal streets radiate, this 248.5-ft. shaft may now be seen at night from the most distant parts of the city.



FAMOUS SOLDIERS' AND SAILORS' MONUMENT FLOOD-LIGHTED

The lighting of the main shaft is accomplished by four banks of twenty-five 500-watt projectors placed on the roofs of buildings which border the Circle. In addition to these main batteries of lamps, two projectors have been placed on each of the pedestal lamps which overlook the artificial waterfall at the base of the shaft. These lamps project red and blue light upon water which cascades from the fountain, producing particularly beautiful color effects. The lighting of the monument has been accomplished after about six months of work, during which time it was necessary to secure the approval of the Monument Board. The equipment for the installation has been loaned by the Merchants Heat & Light Company, and all energy for operating it will be furnished by that company without charge.

## N. E. L. A. Rate Book

In the fall of 1916 the National Electric Light Association will publish its first official annual compilation of electric rates, to be known as the "1916 N. E. L. A. Rate Book," to be followed by quarterly supplements, under the direction of the rate research committee.

This has been undertaken because many of the companies, in studying their own rates, and for information required by the public service commissions and the city councils, have heretofore requested the rates of many other companies. Such demands, being very urgent in character, have always met with prompt response on the part of the individual member companies, or from the N. E. L. A. office in New York; but of recent years they have become so frequent as to be a real source of embarrassment.

With this in mind the National Electric Light Association has directed the rate research committee to publish immediately the rates of all cities of over 40,000 population, and as rapidly as such a publication is supported, to extend the work to include ultimately cities of, say, 10,000. This will put in the hands of the committee complete rate data for future statistical study, and the publication itself will place in the hands of every Class A subscriber the official verified rates of

the companies, removing any chance of stenographic or other errors, which have often crept in when copies have been made.

An important feature of the publication will be the designation by each company of an official rate correspondent who will be responsible for keeping the committee informed of any changes in rates, which will become available in the quarterly supplements. The official correspondent will himself correct all final proof so that only the information officially approved by each company will appear.

All cities in the United States and Canada will be arranged by State or province, and the cities by population. The preface will contain an official description of standard rate forms, with curves, and such abbreviations of terms as may be used throughout the book. The name of each company and its rate correspondent, and whether the plant is hydroelectric or steam, or both, and if power is purchased, will be stated. The population of the city will be given and the territory supplied.

Only the principal rates, such as residence lighting, commercial lighting, retail power and wholesale power will be stated in complete detail, as follows: Availability, rate, determination of demand (particular attention will be given to this item), prompt payment discount, minimum charge, lamp service, term of contract. Any additional feature, or other rates, not in very general use, will be noted by the title only. The volume will be closed by a complete index of company names and cities. Supplements will be issued on Jan. 1, April 1 and July 1 of each year.

## AMERICA'S ELECTRICAL WEEK POSTER COMPETITION

### Announcement Is to Be Made During the Latter Part of July of the Design Selected by the Judges

Noted artists, art students and high school pupils from nearly every leading city, entered posters in the $2200 electrical poster prize competition, conducted under the auspices of the Society for Electrical Development. The competition which was announced in April and closed on June 1, 1916, was for a poster to be used as the official design for America's Electrical Week.

Nearly 800 posters were submitted, one-third of which were by professional artists, whose names are synonymous with the best in poster art. The remainder of the designs were done by younger artists in academies and high schools where industrial art is taught.

For the best posters prizes aggregating $2200 were offered. The first prize of $1000 will be awarded to the winning design which the judges choose as the best and most appropriate poster submitted. Following are the other prizes: $500 second prize, $300 public choice prize, $200 art students' prize and $200 in school prizes.

THREE POSTER DESIGNS SUBMITTED FOR AMERICA'S ELECTRICAL WEEK

The judges will determine the winners of the grand and second prizes, the art students' prize and the school prizes. The announcement of the winners will be made late in July.

The public choice prize will be determined by the highest total of votes registered at exhibitions in New York, Chicago, Cleveland and Philadelphia, in favor of any of the designs deemed suitable for these exhibits by the judges. The New York exhibit drew an attendance of nearly 3000 persons. The Philadelphia exhibit was held at the Exposition Building during the recent convention of the Associated Advertising Clubs of the World.

The judges are: John Quincy Adams, secretary, Art Commission of the City of New York; Dr. James P. Haney, director of art in New York high schools; Herbert S. Houston, president, Associated Advertising Clubs of the World; Arthur F. Wiener, president, International Art Service; P. L. Thomson, advertising manager, Western Electric Company; Henry L. Doherty, president, the Society for Electrical Development, Inc.

The originals for which the prizes are awarded become the property of the society.

## Organization of a National Engineer Reserve

It is reported by the joint committee from the national engineering societies that the War Department is now formulating the plan of organization of the reserve corps of engineers and of the enlisted reserve corps and the requirements that will be prescribed for enrollment therein. This was provided for in the army reorganization act of 1916 which recently passed Congress. As soon as practicable, the War Department will issue an invitation to the engineers of the country to apply for commissions in the reserve corps of engineers, and there will be available for those interested full and complete information as to the requirements for commissions.

# Analysis of Moving Picture Theater Lighting—I

## Results of a Study That Brings Out Importance of Engineering Considerations in Solving Special Lighting Problems of the Picture Theater—Data That Aid in Selection of Equipment and Suitable Projection Screen in Another Article

By L. W. McOmber

Member Engineering Staff, Vaughn, Meyer & Sweet, Consulting Engineers, Milwaukee, Wis.

THE lighting of the Merrill Theater in Milwaukee, Wis., is an interesting example of possible results of a proper engineering consideration of illuminating principles in a new and rather extensive field. This particular theater has been constructed and equipped according to the most modern ideas of interior decoration and furnishing, and the solutions of the lighting problems have been the result of considerable study.

The auditorium of the theater is approached by a lobby 92 ft. long leading from the entrance to a large foyer. From the back of this foyer, broad double stairways lead up to a balcony which has a seating capacity for 300 persons. The auditorium seats approximately 1000, making a total capacity of 1500 people. This auditorium is approximately 50 ft. broad by 150 ft. in length and has a ceiling height of 34 ft. The absence of lighting fixtures makes the dimensions seem even greater, and produces an effect of spaciousness. The interior decoration is rich, but soft and subdued in tone. The walls are stippled in tans and browns of varying shades, touches of color being employed in deep shades of reds, blues and gold in the ornamental friezes, borders and inserts. The floors and aisles are covered with a brown cork tiling, which makes a very good looking, sanitary and durable floor covering. This tiling is soft to walk upon and is entirely noiseless.

### General Plan of Lighting

The interior illumination was laid out to provide a brightly and attractively lighted entrance, and then supply a gradually decreasing intensity of illumination along the route through the lobby, foyer and down to the front of the auditorium, so that the eye would gradually become accustomed to the reduced illumination in the auditorium. The long lobby leading from the entrance is of great assistance in this scheme, as it allows an appreciable amount of time for the adaptation of the eye to the reduced illumination. The actual amount and variation of illumination that is encountered as one enters the theater is shown in Fig. 4. In this diagram the distance traversed is plotted as abscissa and foot-candles illumination as ordinates.

The novelty of the lighting scheme of this theater exists in the fact that, outside of the exit passages and toilet rooms, there are but three lighting fixtures used in the whole installation. The artificial lighting is all indirect or diffused, using indirect lighting fixtures, cove lighting, skylight lighting and flood-lighting. The main portion of the auditorium is lighted by lamps and reflectors, concealed in decorative capitals over ventilator grills, which throw their light on the ceiling to be reflected indirectly therefrom to the auditorium below.

### Illumination of Lobby and Foyer

The lobby is lighted entirely by cove lighting. The lighting units are 60-watt lamps in National X-ray E-60 reflectors concealed by the cornice along both side walls. Each ceiling panel is lighted by four of these lighting units. In the ladies' waiting room, to the left of the lobby at the inner end, the illumination is furnished from a large indirect bowl suspended from the ceiling. The intensity of illumination in this waiting room is slightly greater than that in the lobby, but not markedly so. The foyer is lighted by two indirect units of the same design and size as the one in the ladies' waiting room, each bowl containing four 60-watt lamps in National X-ray reflectors.

The foyer opens directly into the auditorium under the balcony, and the lighting of this portion of the auditorium is accomplished by means of decorative glass skylights. These skylights give a very close approximation to the ideal lighting for an auditorium of this type as the maximum light is thrown downward, lighting the floor and seats but throwing little light on the ceiling, side walls or toward the screen. Opal glass decorated

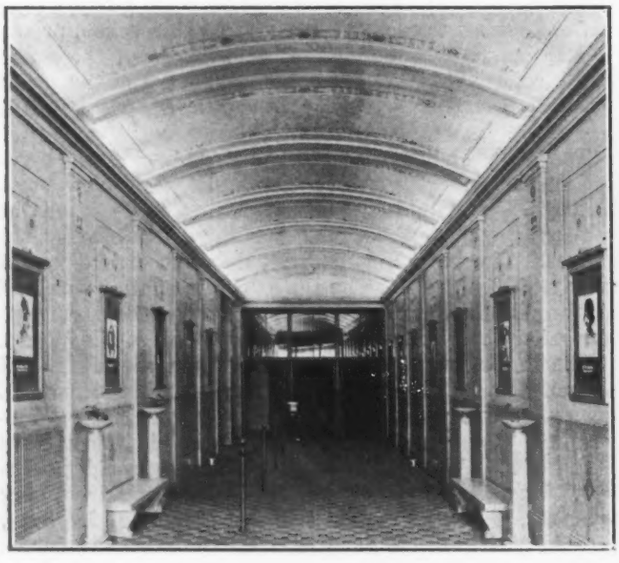


FIG. 1—LIGHTING OF LOBBY, LOOKING TOWARD FOYER

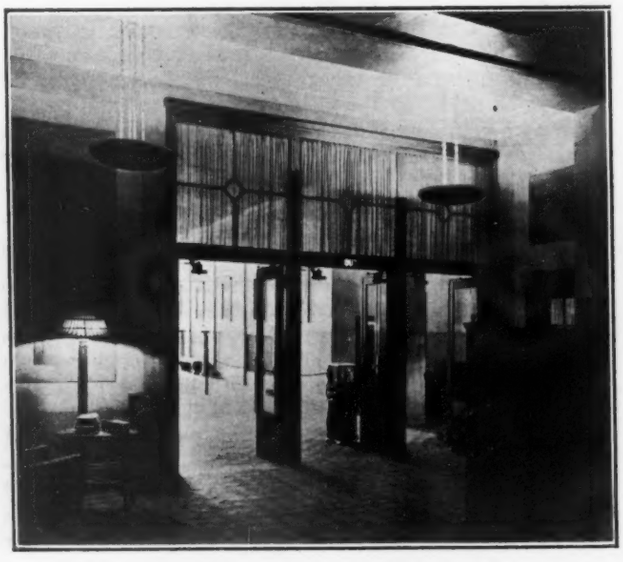


FIG. 2—LIGHTING OF FOYER, LOOKING INTO LOBBY

with a very simple but pleasing design in colored glass is used for these skylights. This space is lighted by six such skylights of varying sizes. Above each skylight is a box or recess for lamps ranging from 12 in. to 30 in. in depth. These recesses are painted with three coats of white paint and are provided with from four to eight outlets around the edge about 4 in. below the top. With this arrangement of outlets, making use of a large number of small wattage lamps there is a very even, spotless lighting of the skylight. It should be noted here that no reflectors whatever are used on these outlets, the whole recess being used as a diffusing reflector.

The double stairway leading to the balcony ascends directly from the back of the foyer. This stairway is lighted at the bottom by means of cove lighting over the center landing. Other stairway landings are lighted by small skylights of the same general construction as the others before mentioned.

### MAIN AUDITORIUM FLOOD-LIGHTED

The main body of the auditorium is entirely lighted by flood-lights. The term "flood-light" is here used to distinguish the lighting from ordinary cove lighting. The general objection to cove lighting is that both the ceiling and the side wall directly over the cove are brightly lighted while the ceiling at other points is, comparatively, only dimly lighted. In this installation, however, the lighting has been accomplished by using concentrating reflectors (National X-ray hood reflectors) set into the walls at such an angle as to throw a nearly horizontal beam of light out onto the auditorium ceiling. The maximum ray of this beam of light strikes the ceiling on the center line of the auditorium, and due to the curve of distribution of the reflector used only a small amount of light strikes the ceiling close to the wall above the unit, resulting in a much more even lighting of ceiling than is usually accomplished.

There are three distinct lighting systems in this scheme for the main part of the auditorium: First, a system giving a low-intensity yellow or white light, which is ordinarily used during projection of the pictures; second, a system giving a low-intensity blue light, which is used when moonlight or night scenes are thrown on the screen so as to make the whole auditorium harmonize in color with the picture, and, third, a system giving a higher-intensity white light, which is used between performances or for lighting the auditorium during the cleaning period. All three systems are controlled from the machine room, the high-intensity system being also controlled from the foyer.

The units of the first system consist of low-wattage vacuum tungsten lamps with their reflectors, the wattage varying from 15 watts near the screen to 40 watts at the rear of the auditorium. The units of the second system are the same as the first units except that the reflectors are furnished with blue glass fronts and the lamps are of higher wattage to make up for the absorption of the colored glass. The units of the third system consist of large-wattage gas-filled tungsten lamps in National X-ray E-155 reflectors. The resulting illumination of the ceiling is not as satisfactory with these units as is the case with the other lights, since it was

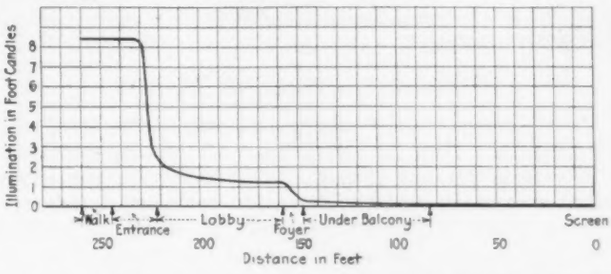



FIG. 4—VARIATION IN ILLUMINATION THROUGHOUT THEATER

not practical, owing to space limitations, to use reflectors which would give as good a distribution on the ceiling for the high-wattage lights as it was for the other systems. However, as these lights are chiefly used for the cleaning of the theater, it is not so important.

### SAFETY FEATURES OF LIGHTING INSTALLATION

The lighting of the entire theater is on two separate and distinct wiring systems, each system being connected to a separate service. The regular service, together with its wiring system, furnishes practically 90 per cent of the lighting outlets, the other 10 per cent being furnished through a second emergency service entering the theater from an entirely different street service and feeder. This emergency service is used, first, for the lighting of all exit signs, and, secondly, for the lighting of "panic" or emergency lights. These emergency lights are used as part of the regular lighting system, every skylight, cove or indirect fixture having one or more lights in it connected on this emergency service. If the regular service should fail for any reason whatsoever, then the emergency lights on the emergency service would still furnish enough illumination throughout the theater to permit the audience to leave in safety.

All passageways leading to exits are illuminated by lights on the regular and emergency service as well, so that the passageways will be lighted under all conditions. Lights are also provided outside of all exit doors. The emergency lighting is controlled entirely at the

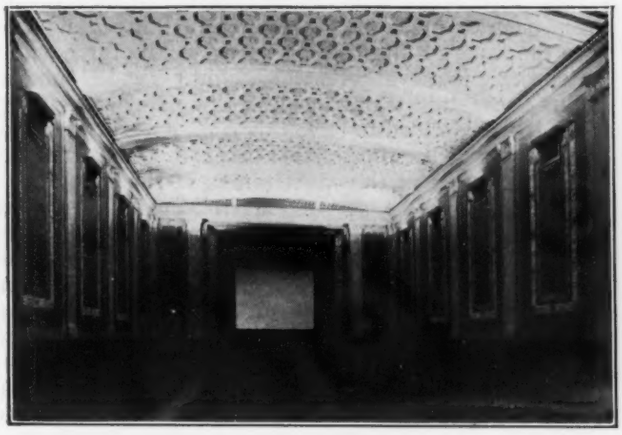


FIG. 3—LIGHTING FOR SCREEN END OF AUDITORIUM

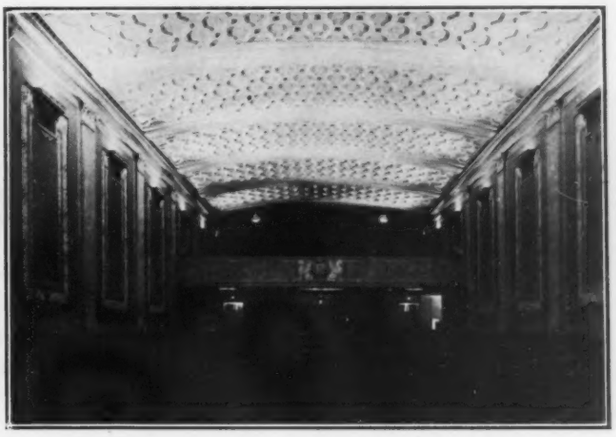


FIG. 5—LIGHTING FOR REAR OF AUDITORIUM

distribution cabinet, located in the foyer. A three-way switch in the machine room is used to control the emergency lights in the first and second systems of auditorium lighting, so that either the white or the blue lighting can be thrown on by the operator, yet it is impossible to cut off both lights at the same time. The ceiling lights on the regular system are also controlled by a second control switch in the foyer of the theater. All of the skylight outlets and foyer lights on the regular service are controlled by push switches in the foyer, and the lobby lights are controlled from a cabinet in the manager's office.

### EXTERIOR LIGHTING OF THEATER

The display or advertising lighting of the theater is divided into three general types of lighting for three different purposes; that is, first, to attract the attention; second, to hold the attention and impart information concerning the amusement and, third, to furnish a brightly and attractively-lighted entrance to the theater itself. The first is accomplished by a large electric monogram clock with figures 3 ft. in height, which show the correct time from sundown until midnight. The clock is high up on the building and, due to its location, can be seen for blocks up and down Grand Avenue, drawing the attention for a considerable distance.

Above the entrance canopy, extending over the full width of the sidewalk, is erected a large electric sign, as shown in the illustration, which serves the second purpose stated above. The word "Merrill" is of 24-in. trough letters. The other words are composed of 18-in. trough letters. These letters are painted white and lighted by means of 10-watt tungsten sign lamps. Each lamp is covered with a white opalescent color cap, so that when the sign is lighted the letters stand out brilliantly, yet there is practically no glare from the lamp filament itself. This construction gives a very evenly-lighted letter, and one that can be read at a greater distance than a letter made of bare studded electric lights.

Around the edge of the sign and on the crown and ornamentation at the top are hung more than 1000 cut-

FIG. 6—ELECTRIC SIGN AND MONOGRAM CLOCK AT THEATER ENTRANCE

glass jewels similar to those used at the San Francisco exposition. These jewels are hung from small ring supports, being free to swing in air currents. To bring out the scintillating effect of the jewels the sign is illuminated by flood-lights placed on the corners of the building and on the canopy over the sidewalk. The lower portion of the sign forms a program sign equipped with interchangeable 16-in. trough letters of the same style and construction as the letters above. These letters are supported and connected by the Chase system of removable letters, which allows any spacing desired.

Underneath the canopy itself the space is lighted by 60-watt lamps, placed in a deep trough around the three outer sides of the canopy, the trough being of such a shape as to throw a considerable amount of light on the glass panels and letters forming the sides of the canopy, and also to reflect a large amount of light on the side-

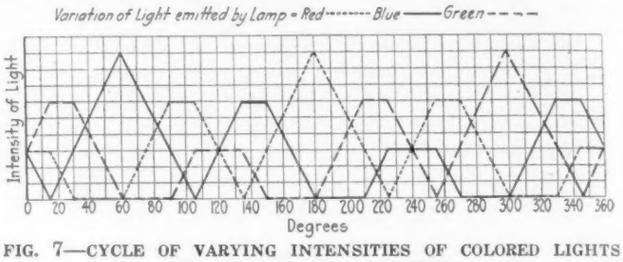

Variation of Light emitted by Lamp - Red ····· Blue —— Green - - - -
Intensity of Light
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Degrees

FIG. 7—CYCLE OF VARYING INTENSITIES OF COLORED LIGHTS USED IN ENTRANCE LIGHTING

walk beneath the canopy. This lighting is supplemented by a hemispherical bowl in the center of the canopy containing four 100-watt gas-filled lamps. The whole gives a very brightly-lighted front and sidewalk space without any lamps being visible, and with very little glare.

### COLOR MIXING IN ENTRANCE LIGHTING

In planning the lighting for the entrance to the theater, it was desired to have something that would be attractive and artistic, but not gaudy. Some scheme giving unusual and novel effects seemed necessary for working out the display lighting for this type of building. The plan finally decided upon was a "color synthesis" or color change effect in the outer lobby; that is, the changing of the tints of the front lobby lighting gradually and smoothly from shade to shade, and color to color, with no abrupt changes, but only a gradual blending of one color into another. At the same time it was necessary that the intensity of the entrance lighting should be approximately constant. These requirements led to a study of automatic color mixing and the means of obtaining such a mixing, and eventually led to the working out of a cycle of operations using lights of the three primary colors. Each of these colors is varied in intensity from instant to instant, giving a resulting color which constantly changes. The cycle of varying intensities applied to these colors is shown in Fig. 7. It will be noted that the cycles of all colors are identical, the mixture being obtained by shifting the various colors so that there is an angular difference of 120 deg. between equal intensities of each of the three colors. With this arrangement there is at no time the same resultant color, except at the three points where there is a synthetic white light. Yet the amount of flux is constant throughout the complete cycle. Originally it was decided to have this cycle cover a period of one and one-half minutes, but later this time was decreased to augment the effectiveness of the changes.

In order to make use of this scheme, the entrance is lighted entirely by indirect lighting, making use of six lamps and reflectors placed on top of the ticket booth. These six units are each furnished with ventilated holders over the tops of the reflectors, holding the colored glass plates, respectively, red, blue and green.

To obtain the variation of light required, as shown by the curves Fig. 7, three single-phase dimmers are connected in circuit with the lighting units, one dimmer for each color. These dimmers are mounted on a slate

panel, the contact arm being rotated by means of a spur gear and rack operated by levers connected to the cam, one motor-driven shaft carrying all the cams. The dimmer plates are each designed for the particular wattage it has to dissipate, so that the cams are all identical in size and shape, the only difference being that they are mounted on the common shaft 120 deg. apart. In order to obviate any noticeable flicker or sudden change in the illumination, the resistance steps of the dimmers are very small, as the resistance is first cut in, becoming greater as the lamp filament becomes less bright. In order to determine the proper shape of cam and the size of resistance steps to be used, the voltage-candle-power curves of the lamps were taken, and from this the proper cycle of potential was figured out for the lamps used. To allow for the absorption of the different colors it was necessary to use different-size lamps with the various colors in order to furnish approximately the same amount of illumination from each color. It was found that for all practical purposes a combination of two 1000-watt gas-filled tungsten lamps for blue, two 1000-watt lamps for red, and one 1000-watt lamp for the green, gave very good results.

In order to inform the public of the attraction at the theater, two program display frames mounted at each side of the entrance are flooded with strong white light. These give more prominence during the evening hours. The lighting units for this service were placed above and in front of the frames, out of the range of vision, but throwing the light down at an angle high enough to clear the heads of people standing in front of the announcements. It was found, upon investigation, that for this particular installation better results could be obtained by using a lens in front of a concentrated filament lamp, silvered on the back, than with any commercial reflector on the market, and this scheme was worked out and used. With a 100-watt round-bulb lamp it is possible to put the complete unit in a cylinder having an over-all length of approximately 8 in. and a diameter of 4 in., making a unit which is small enough to be easily concealed, and even where exposed it is not of a large enough size to be noticed by the general public.

### VENTILATION OF MERRILL THEATER

The air supplied to the auditorium is drawn from above the roof by a large motor-driven fan passed through an electrically-operated air washer and then heated (during the winter months) and delivered under pressure through a large number of "mushroom" openings in the floor of the auditorium under the seats. In order to provide an even flow of air by this method of heating and ventilating, the entire basement under the auditorium is used as an air chamber. The amount of air through each "mushroom" opening is regulated by adjusting the cover so that all openings may be made to deliver approximately the same amount of air independent of location. The ventilation is further assisted by a large suction fan on the top of the theater, which draws the air out of the auditorium through registers in the side walls, approximately 25 ft. above the floor. For cold weather the heating is augmented by direct radiation in the form of radiators set behind grills in the side walls of the auditorium, foyer and lobby.

Another section of this article will take up problems in the selection of a projection screen.

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# Inductance of Conductors at Close Spacings

## Measurements of Inductance of Copper Tubing Showing Effect of Spacing and Frequency Under Conditions Approximating Cable Construction

BY FRANCIS B. SILSBEE

IN view of the frequent use of conductors at close spacing in cables, it is important to determine the conditions under which copper conductors at moderate frequencies operate most satisfactorily. In the calculation of the inductance and capacity of transmission lines, the formulas usually applied are:

$$L = 4 \log \frac{d}{a} + L_i \qquad (1)$$

and

$$C = \frac{1}{4 \log \frac{d}{a}} \qquad (2)$$

where

$L$ is loop inductance per centimeter length; $C$ is capacity between wires per centimeter length; $d$ is spacing of wires center to center; $a$ is radius of wire and $Li$ is so-called "internal inductance" of the wire.

These formulas are undoubtedly correct and can be very simply deduced, for the case where $\frac{d}{a}$ is large. However, when $\frac{d}{a}$ is small formula (2) is very much in error as has been shown by Kennelly[2] and others. The exact expression is,

$$C = \frac{1}{4 \cosh^{-1} \frac{d}{2a}} \qquad (3)$$

Equation (3) is correct for all spacings while (2) is merely an approximation which becomes more exact as $\frac{d}{a}$ increases. The physical difference between the two cases is, that a direct derivation of equation (2) requires the assumption that the electrostatic charges on the wires are uniformly distributed around their circumference. Equation (3) takes account of the fact that when the wires are near together the mutual attraction of the charges causes the surface density of charge to be greater on the adjacent sides of the wires.

In the case of inductance the phenomenon is complicated by the fact that not only do the induced emfs. tend to make the currents crowd together, in a manner analogous to the electrostatic case, but also the resistance of the conducting material tends to maintain a uniform distribution of current over the cross-section of the wire. If the former effect is overwhelming, as is the case with perfect conductors or very high frequencies, the formula

$$L = 4 \cosh^{-1} \frac{d}{2a}, \qquad (4)$$

which is analogous to (3) is correct. On the other hand, if the resistance effect predominates, as at low frequencies and with materials of high resistivity, then formula (1) is correct for all spacings.

In order to determine experimentally which condition was more nearly satisfied by copper conductors at moderate frequencies specimens of commercial copper tub-

[1]Presented as part of a thesis for the degree of Doctor of Philosophy at Harvard University, 1915.

[2]Proc. Am. Philos. Soc., Vol. 48, p. 142, 1909.

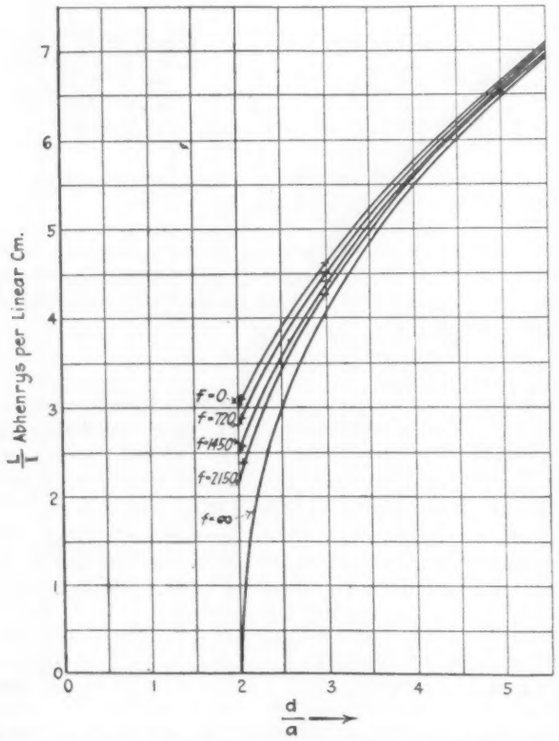
TABLE I—EFFECT OF SPACING ON INDUCTANCE OF PARALLEL COPPER TUBES RESULTS AT 60 ∞

| Test Number | $\frac{d}{a}$ | $\frac{L}{l}$ obs.[1] [2]abh/cm. | $\frac{L}{l}$ corr [2]abh/cm. | $4 \log \frac{d}{a} + Li$ |
|---|---|---|---|---|
| 1- 2 | 50.00 | 15.96 | 15.86 | 15.86 |
| 24-25 | 49.76 | 15.97 | 15.87 | 15.84 |
| 20-21 | 20.10 | 12.20 | 12.18 | 12.21 |
| 22-23 | 20.08 | 12.25 | 12.23 | 12.21 |
| 7- 8 | 10.04 | 9.43 | 9.42 | 9.43 |
| 5- 6 | 5.03 | 6.79 | 6.78 | 6.67 |
| 11-12 | $3.02_0$ | $4.61_1$ | $4.61_1$ | $4.63_6$ |
| 9-10 | $3.00_4$ | $4.62_5$ | $4.62_5$ | $4.61_2$ |
| 3- 4 | $2.02_0$ | $3.14_1$ | $3.14_1$ | $3.02_4$ |
| 16-17 | $2.04_8$ | $3.08_3$ | $3.08_3$ | $3.08_0$ |
| 18-19 | $2.03_6$ | $3.07_6$ | $3.07_6$ | $3.05_6$ |

[1]Observed; [2]absolute-henrys.

ing 1.27 cm. external diameter and 0.10 cm. thick were used in the experiments. The tubular shape was selected because the correction term $L_i$ was thereby made quite small ($0.053.10^{-9}$ henrys per linear centimeter in this case). The tubes were 180 cm. long and the spacing could be varied from 50 radii down nearly to 2. Potential leads were attached to each tube at points 60 cm. and 120 cm. from the closed end of the circuit, and the inductance of the four-terminal conductor formed by each pair of potential leads and the main circuit was measured. The difference in the values thus obtained was taken as the inductance of the 60 cm. of circuit between the two pairs of potential leads. Corrections were applied to take account of (1) the mutual inductance between the connecting bar at the end of the circuit, and the potential leads, and (2) the fact that the conductor did not extend to infinity but terminated at the connecting link. These corrections in no case exceeded 1 per cent and were usually entirely negligible. They were computed on the assumption that the conductors were replaced by their central filaments.[3]

The measurement of inductance was made by a substitution method in which the circuit under investigation $X$ was compared with a standard 0.001 ohm resistance $S$ of known inductance. The procedure was to determine the phase angle of a current transformer by one of the usual null methods[4] using $S$ as the standard




EFFECT OF SPACING AND FREQUENCY ON INDUCTANCE OF COPPER TUBES

TABLE II—EFFECT OF SPACING ON INDUCTANCE OF PARALLEL COPPER TUBES DIFFERENT FREQUENCIES

| Test No. | $\frac{d}{a}$ | Freq. Cycles/sec. | $L_1$ abhenrys | $L_2$ abhenrys | $L/l$ abh/cm. | $4 \log_e \frac{d}{a} + Li$ | Diff., per Cent |
|---|---|---|---|---|---|---|---|
| 29-30 | 2.048 | 716 | 358.3 | 185.1 | 2.873 | 3.080 | 7.2 |
| 53-54 | 2.048 | 1460 | 319.5 | 163.1 | 2.594 | | |
| 33-34 | | 1500 | 321.5 | 170.6 | 2.553 | 3.080 | 20.0 |
| 35-36 | 2.048 | 1500 | 322.1 | 167.4 | 2.565 | 3.080 | 17.9 |
| 51-52 | | 2140 | 294.0 | 150.7 | 2.375 | | |
| 31-32 | 2.048 | 2148 | 296.9 | 154.5 | 2.363 | 3.080 | 25.0 |
| 26-27 | 49.760 | 750 | 2135.0 | 1171.0 | 15.89 | 15.84 | 0.3 |
| 41-42 | 3.000 | 710 | 558.2 | 285.8 | 4.518 | 4.608 | 2.0 |
| 39-40 | 3.000 | 1438 | 542.8 | 277.2 | 4.405 | 4.608 | 4.6 |
| 37-38 | 3.000 | 2140 | 533.6 | 275.7 | 4.277 | 4.608 | 7.5 |
| 43-44 | 5.004 | 730 | 814.5 | 413.6 | 6.65 | 6.652 | 0.1 |
| 45-46 | .... | 1430 | 808.0 | 409.8 | 6.60 | 6.652 | 0.8 |
| 47-48 | .... | 2190 | 808.3 | 411.6 | 6.58 | 6.652 | 1.2 |

resistance in the primary circuit. Then $X$ was inserted in place of $S$ and the phase angle again determined. The apparent change in phase angle of the transformer is due to the difference in the phase angles of $S$ and $X$; and from this difference and the known inductance of $S$, the inductance of $X$ is easily calculated.

The results of the measurements at 60 cycles are given in Table I. Column IV gives the observed inductance per centimeter of circuit for the spacings given in Column II, after the corrections mentioned above have been applied. Column V gives the values computed from equation (1). The agreement is well within the experimental error and indicates that up to this frequency the current remained uniformly distributed over the cross-section of the tube.

Further measurements at the three closest spacings were made at higher frequencies up to 2100 cycles. The results are given in Table 2 and are indicated by + marks on the plot. It was found that these values can be represented by the empirical formula,

$$L = 4\left\{\log \frac{d}{2a}\left[1 + \sqrt{1 - F\left(\frac{2a}{d}\right)^2}\right] + G\right\} \qquad (5)$$

TABLE III—OBSERVED CONSTANTS OF EQUATION (5)

| Frequency, Cycles/sec. | $F$ | $G$, abh/cm |
|---|---|---|
| (0) | (0.) | (0.053) |
| 60 | 0.00 | 0.053 |
| 720 | 0.18 | 0.053 |
| 1450 | 0.42 | 0.053 |
| 2150 | 0.58 | 0.053 |
| (∞) | (1.00) | (0) |

where $F$ and $G$ are functions of frequency but not of $\frac{d}{a}$. $G$, which represents the internal inductance, was practically constant over the range of frequency used. The values of $F$ are given in Table 3. Equation (5) goes over into the two theoretical formulas (1) and (3) if

$$\text{at } f = o, F = O \text{ and } G = \frac{L_i}{4}$$

$$\text{and at } f = \infty \; F = 1 \text{ and } G = O.$$

These results bring out very clearly the ideas suggested in a recent paper by Kennelly, Laws, and Pierce,[5] namely $F$ is a measure of what these authors call the "proximity effect," and is very pronounced at 2000 cycles, while the decrease of $G$ is a measure of the "skin effect" in the narrower sense and is negligible up to this frequency.

It is to be hoped that these measurements may be extended to a greater variety of sizes and thicknesses of tubes, and to solid wires.

[3]Bull. Bureau of Standards, Vol. 8, p. 151, et seq.

[4]A more detailed description of this "Current Transformer Method" of comparing the inductances of low resistance standards is to be published shortly in the Bulletin of the Bureau of Standards.

[5]Proc. A.I.E.E., Aug., 1915, p. 1750.

# Lightning Protection of 4000-Volt Circuits

## Results of an Extensive Investigation to Improve Lightning Protection, Which Was Made by the Commonwealth Edison Company and Has Justified the Expense by the Improvement in Service

SINCE the paper on "Lightning Protection of 4000-Volt Circuits," which was presented by D. W. Roper at the recent annual meeting of the American Institute of Electrical Engineers, has been credited by many members of that association as being one of the most valuable contributions to the electrical industry, comparing as it does theory with practice, a detailed abstract is presented herewith.

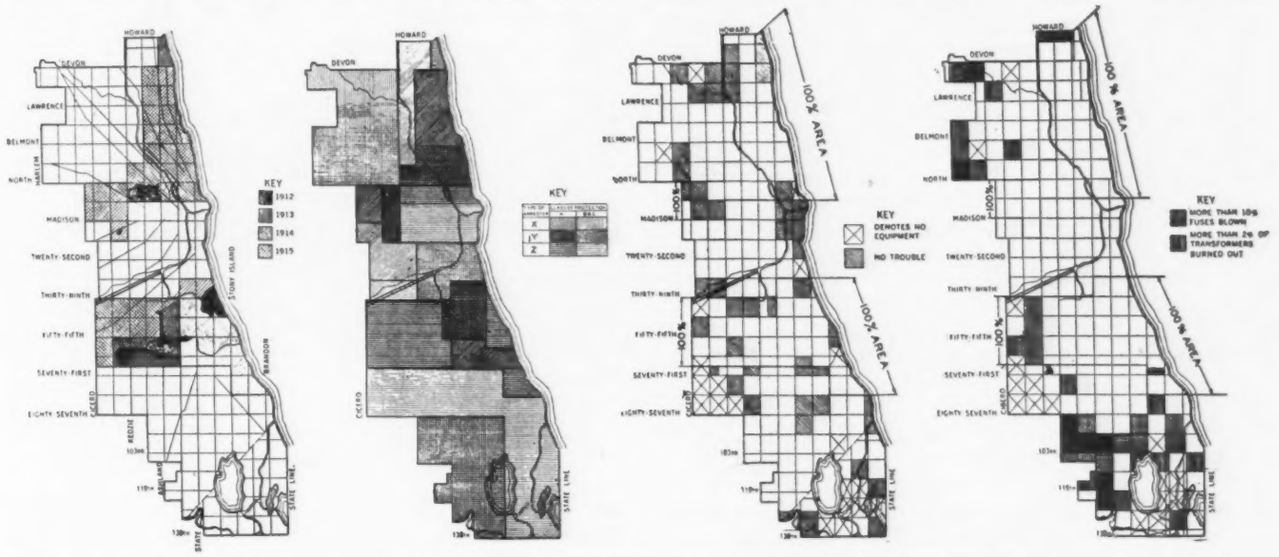
In this paper the author pointed out that considerable trouble from lightning has been eliminated in Chicago by removing transformer terminal boards and installing lightning arresters on the same poles with the transformers. Based on five years' investigation of Chicago's 4000-volt electric service system, which included 3000 miles of circuit and 16,000 transformers, the following conclusions have been made:

Regardless of whether the lightning arresters are on line poles or on transformer poles, the protection appears to be improved by an increase in the number of arresters per square mile or per mile of line. While a lightning arrester on the same pole with each transformer appears to be quite adequate protection in a region where the transformers are reasonably close together, the protection appears to be inadequate where the transformers are separated by distances greater than 2000 ft. Construction is considerably simplified by the use of self-contained arresters which do not require inspection. The modern types of lightning arresters are so free from trouble that the installation of a fuse in series with the arrester, for the purpose of disconnecting the arrester in case of trouble, is not warranted. While the installation of lightning arresters for the protection of transformers is not warranted by the saving in the cost of repairs to transformers in Chicago, it can be justified because the quality of the service is improved thereby.

The distribution system of the Commonwealth Edison Company, on which investigations were made, is four-wire, three-phase, with 2400 volts (nominal) between each phase wire and the neutral wire, the latter being grounded only at the substations. The system is supplied by 125 feeders from fifteen substations. On the average the feeders extend nearly 2 miles underground before connecting to the overhead lines, and the length of the overhead feeders is about 25 per cent of the total length. There are, roughly, 3000 miles of primary distributing mains, of which less than 10 per cent is underground. About 100 of the distributing transformers are located in manholes or in transformer vaults on the customers' premises.

### PRELIMINARY STUDIES

As the object of the investigation was to improve the service a preliminary study was first made of all of the interruptions on the distribution system. These were classified according to their cause. This showed that transformer troubles were responsible for more interruptions to service than any other single item, and also that a large fraction of all transformer troubles were primarily due to lightning. The need for further investigation of lightning protection methods was, therefore, very apparent.




FIGS. 1, 2, 3 AND 4—MAPS SHOWING PROTECTIVE AREAS, LOCATION OF DIFFERENT-TYPE ARRESTERS, SECTIONS ENTIRELY FREE FROM LIGHTNING TROUBLE AND TERRITORIES SUBJECTED TO ABNORMAL TROUBLE

### STARTING THE INVESTIGATIONS

The first step in the investigation was to make a careful record of all transformer fuses blown by lightning during one severe storm. According to indications most of the arcing occurred on the primary terminal board between the terminals or from the terminals to the cover. In a smaller number of instances, the arcing had occurred around the primary bushing either inside or outside of the transformers, or between the primary lead and the case. Further, it was found that transformers from which the terminal boards had been purposely removed were giving excellent service, therefore it appeared that the practice warranted further investigation. For this purpose the terminal boards were removed from 250 transformers on one circuit. No changes in the scheme of lightning protection previously in use were made, so that aside from the removal of

terminal boards this circuit was equipped in the same manner as the other circuits. In order to secure information regarding the relative merits of several types of arresters, only one type of arrester was installed on any one circuit, a portion of the arresters being moved each year until the segregation of arresters by circuits was completed.

### LIGHTNING ARRESTERS ON TRANSFORMER POLES

For the purpose of verifying a theory that lightning arresters, to be most effective, should be on the transformer poles, two circuits were selected in 1912 on which there were about 300 transformers, and on each circuit an arrester was installed on the same pole with each transformer. A different type of arrester was used on the two circuits. This installation differed from previous practice in that (1) the number of arresters equaled the number of transformers instead of being only a small fraction of their number, and (2) the arresters were placed on the transformer poles instead of on the line poles.

From an analysis of the effects of two severe lightning storms the areas protected as described showed an almost entire absence of lightning trouble, but a number of areas protected only by a few arresters on the line poles were also remarkably free from lightning trouble. This indicated very plainly that it was quite impossible to definitely determine from the records, or from any subsequent examination on the ground, whether the freedom from trouble was due to the perfection of the protection or to absence of lightning.

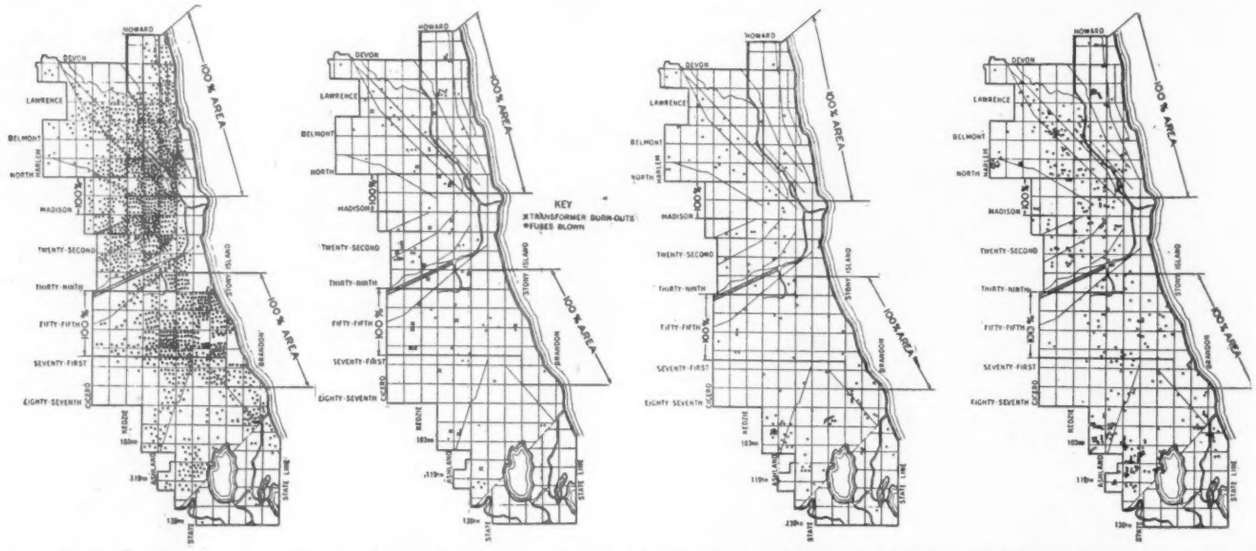
To secure more reliable information regarding the advantages of removing terminal boards and the relative merits of the several types of arresters, the protected areas were enlarged by the addition of several circuits, each having but one type of arrester and containing a total of about 1600 transformers which had been altered as mentioned.

The records subsequently obtained demonstrated, first, that the removal of the terminal boards from transformers would eliminate about 60 per cent of the troubles due to lightning, and, second, that the installation of lightning arresters on the same pole with each transformer made a very considerable additional reduction in the amount of trouble from lightning, as compared with previous practice of installing a few arresters on the line poles. It was, therefore, decided to remove the terminal boards from all transformers which were returned to the storeroom for any reason, and to specify that all new transformers should be without terminal boards.

In an investigation of the effects of subsequent storms it was noted that a fairly constant ratio existed between the number of primary fuses blown and the transformers burned out by lightning. From later investigations it became apparent that, while the ratio may perhaps be fairly constant during one lightning season, it decreased very considerably during four years. It was therefore considered inadvisable to use the record of blown primary fuses instead of the record of burned-out transformers for the purposes of comparing one year's records with another.

### RESULTS WITH TRANSFORMER CASES GROUNDED

To test the theory that grounding transformer cases decreases the trouble from lightning, three circuits on which there were about 600 transformers were selected, and each of the transformer cases was connected to the lightning arrester ground wire through a primary cut-out. While it is possible that the number of transformers included in the experiment was inadequate for the purpose, and the records misleading due to the variableness of lightning storms, the results for three years seem to indicate that the grounding of the transformer cases has but little effect upon the efficiency of the lightning protection. As a matter of fact, there was slightly more trouble on these particular circuits than the average for other circuits, this trouble taking the nature of the burning off of the primary leads.




FIGS. 5, 6, 7 AND 8—MAPS SHOWING LOCATION OF TRANSFORMERS, TRANSFORMER BURN-OUTS AND FUSE BLOW-OUTS IN ONE STORM, ALSO SAME INFORMATION INDICATED ON SEPARATE CHARTS FOR ENTIRE YEAR OF 1915

Prior to starting these experiments, it had been assumed that one of the principal objects of the primary fuse was to protect the transformers from overload, but afterwards it was decided that they are to protect the service by disconnecting a defective transformer. Accordingly, 25-amp. fuses were determined upon for all transformers rated at values up to 10 kw., and 40-amp. fuses for transformers rated at 15 to 40 kw.

Although the results obtained during 1914 added very little information regarding the best type of arresters, the records continued to indicate a very decided advantage for the scheme, which is termed 100 per cent protection, and it further appeared that comparatively little benefit was being received from the lightning arresters installed on the line poles. As a result of this information, it was decided early in 1915 to increase the 100 per cent protection areas (1) by moving all arresters on line poles (about 1000 in number) to the transformer poles and (2) by installing about 3000

additional arresters. Previous to this, however, it had already been decided that the extra expense of installing a lightning arrester on the same pole with each transformer was warranted in the case of all important power customers and later for all installations requiring transformers above 3 kw. capacity.

At the opening of the lightning season in 1915 there were in service three classes of protection: Class A included the transformers which had an arrester on the same pole, and which were located in so-called 100 per cent areas, that is, in areas where each transformer is similarly protected. Class B included the transformers outside of the 100 per cent areas which were protected by arresters on the same pole. Class C included all transformers that were not protected by arresters on the same pole.

### REDUCTION IN THE RATIO OF PRIMARY FUSES BLOWN TO TRANSFORMERS BURNED OUT

While the number of primary fuses blown and the burn-outs due to lightning during the past four years have varied over rather wide limits from year to year, the ratio between these two quantities during the same period has been decreasing along a very regular curve, indicating the existence of some law or progressive change connecting these two quantities. For the purpose of securing information on this point a table was prepared showing the ratio in question for the several classes of protection during 1915. This table showed that the ratio is smaller for the class B and C protection than for class A. This ratio, being the larger for the best class of protection, indicates that the other variables have a greater effect on this ratio than the lightning arresters. A study of the reduction in the percentage of terminal boards and in the percentage of fuses blown by lightning indicated that the percentage reduction in fuses blown is directly proportional to the percentage of terminal boards removed.

The records available did not permit an exact determination of the benefits derived from increasing the number of arresters as distinguished from the benefits obtained by moving the arresters from the line poles to the transformer poles, but from all of the information it was estimated that a reduction of 59 per cent in fuses blown obtained by the removal of 30 per cent of the

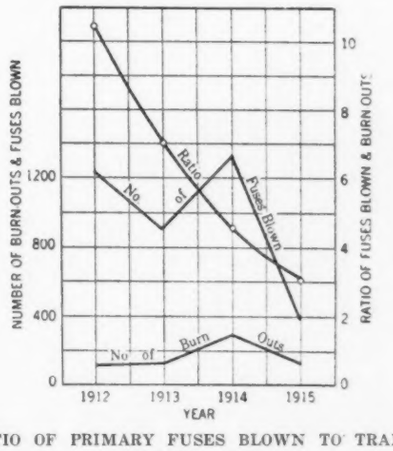



FIG. 9—RATIO OF PRIMARY FUSES BLOWN TO TRANSFORMERS BURNED OUT

terminal boards could be attributed to the following causes in the accompanying proportions:

| | Per Cent | Per Cent of Total |
|---|---|---|
| Removal of terminal boards | 18 | 30 |
| Increasing the ratio of arresters to transformers | 10 | 20 |
| Moving arresters from line poles to transformer poles | 31 | 50 |
| | 59 | 100 |

If this estimate proves correct it means that the amount of trouble from lightning on a system with all the terminal boards removed and with lightning arresters equal in number to the transformers and installed on the line poles, would be reduced about one-half by moving the lightning arresters from the line poles to the transformer poles.

From a further comparison of the several classes of protection it was concluded that the improvement of class A protection over class B must be due to the larger

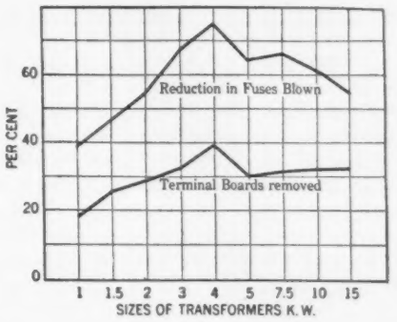



FIG. 10—RATIO OF PRIMARY FUSES BLOWN TO TERMINAL BOARDS REMOVED

number of arresters per square mile, or per mile of line, there being about ten times as many transformers per square mile for class A protection as for class B. The records also indicated that the installation of an arrester on a transformer pole does not give perfect or complete protection but that the protection is considerably improved by other arresters on neighboring poles. This means that widely separated transformers along a long line, or isolated at the end of a line, if supplying important service should be protected by installing other arresters in the vicinity in addition to those on the transformer pole.

It was also concluded that lightning arresters protect transformers against a large fraction of the lightning strokes, but that the rest of the strokes, which are probably of a very high frequency and large volume, are beyond the capacity of the arrester. Stated more specifically, some lightning strokes are of comparatively low frequency and moderate volume, so that an arrester placed anywhere along the portion of the line affected by the stroke will protect the transformers. This type of stroke is the only kind that is seriously affected by the old-fashioned scheme of scattering a few arresters along the line poles. For strokes of higher frequency it becomes necessary to have the arresters nearer the transformers, and this may be accomplished in part by installing an arrester on the pole next adjacent to each transformer. For strokes of very high frequency, however, the arrester on the pole next adjacent to the transformer is no longer sufficient, and the arresters must be placed immediately alongside the transformer. There still remain strokes of such high frequency and volume that a single arrester on the transformer poles becomes inadequate on account of its limited discharge capacity. This may account for the damage done to the transformers that are so protected.

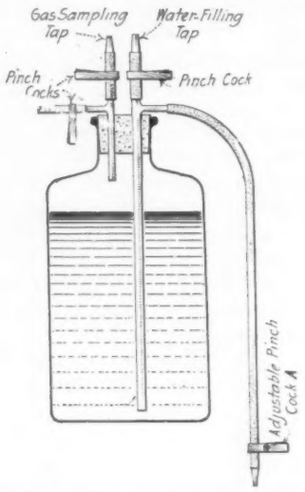
Where transformers are separated by considerable distances, or are located at the end of a long line, the indications are that a single arrester on the transformer pole will again prove inadequate. In order to secure the best protection, therefore, a certain minimum distance (not yet determined) between arresters should be decided on so as to protect against the lightning strokes of moderate frequency and considerable volume, which cannot be discharged by a single arrester, and which are apparently a fair proportion of the total number of strokes. In closing the author called attention to the inaccurate conclusions that may be drawn from considering isolated cases.

# STATION AND OPERATING PRACTICE

*A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy*

## Method of Continuously Sampling Flue Gas

By connecting with the smoke flues a 5-gal. bottle filled with water and equipped as indicated, C. B. Hudson, superintendent of a power plant in Ithaca, N. Y., has been able to obtain continuous gas samples over periods of eight hours. By so doing it has been convenient to keep a constant check on the firemen's operations. The cost of the whole outfit was about $2 including labor. Valve *A* is adjusted so that water will drip just fast enough to empty the bottle in eight hours. According to Mr. Hudson, this arrangement maintains constant pressure in the bottle and consequently uniform gas admission.




A CONTINUOUS FLUE GAS SAMPLER

## Advantages of and Obstacles to Adopting Higher Steam Pressures

Considered purely from a thermodynamic viewpoint, an increase of pressure from 200 lb. at 200 deg. superheat to 600 lb. at no superheat (giving the same steam temperature) will theoretically permit a 32 per cent increase in prime mover efficiency with atmospheric exhaust and 13.4 per cent with a 29-in. vacuum. On the other hand, however, mechanical obstacles must be surmounted to permit using the higher pressure. In the recent report of the N.E.L.A. committee on prime movers, Robert Cramer pointed out that operating at higher pressures will probably require a complete revision in boiler design to withstand the increased pressure safely. Most boiler fittings, pipes and valves as made at present are of sufficient strength for 600 lb. pressure, but the latter may need slight modification to facilitate operation. The construction of engines and turbines may have to be strengthened, however. The greatest difficulty with regard to engine or turbine design will probably be to minimize friction and leakage.

Since higher steam pressure will mean higher water temperature in the boilers, the efficiency of heat transmission at the boiler surfaces will be reduced and the stack temperature consequently increased. The heat discharged up the chimney may be recovered in part, however, by economizers, but these too will have to be designed to withstand the higher pressure. Higher steam pressures also mean larger temperature differences during expansion. This does not present a serious difficulty in turbines or in uniflow engines, but it may in some reciprocating engines due to condensation. Entrained moisture, which is very liable to exist in unsuperheated steam, may, however, corrode turbine blades. In one way entrained moisture is beneficial since it reduces the amount of condenser surface required. With higher pressures larger bearing surfaces or better lubrication will be needed in contact with steam, but these do not constitute an obstacle in view of the conditions which are already satisfactorily handled in combustion engine operation. Leakage at pipe and fitting joints can probably be prevented by welding them. Mr. Cramer pointed out that while it is hardly reasonable to expect the general introduction of pressures as high as 1500 lb., pressures of 400, 500 and even 600 lb. seem to be in immediate prospect. As far as constructing boilers for operating at such pressures is concerned, one large manufacturing company has stated that if the demand is sufficient it can turn them out in commercial designs.

## An Automatic Cut-Out for Water Tank Pump Motor

The automatic cut-out switch shown in Fig. 1 is used on a water tank at the Stone Mountain substation of the Georgia Railway & Power Company. The switch is closed by hand when it is necessary to start the motor which pumps water into the tank. A stop, as indicated in Fig. 2, is fastened on the water gage corresponding

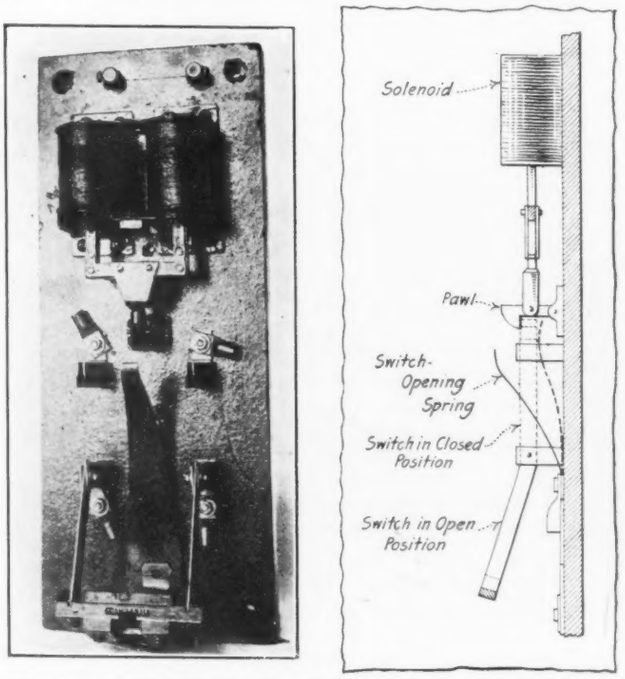



FIG. 1—ARRANGEMENTS OF MOTOR SWITCH AND RELEASING SOLENOIDS

to full capacity of the tank. When the pointer touches this stop the circuit to the energizing coils is closed so that the coils pull up the cores and release the switch. A heavy spring back of the switch forces it out and opens the motor circuit. This spring throws the switch out so hard that a heavy rubber stop is placed at the bottom of the panel. This device was built under the direction of E. P. Peck, superintendent of department tests and repairs of the Georgia Railway & Power Company.

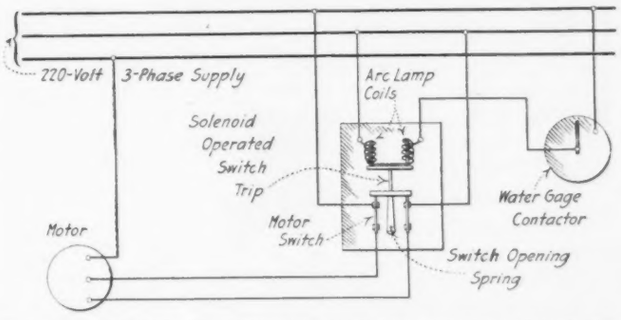



FIG. 2—CIRCUITS OF AUTOMATIC MOTOR CUT-OUT FOR WATER TANK PUMP

## Installation Methods Used by Illinois Company in Placing New Turbine

All the work in connection with replacing a 2000-kw., 25-cycle turbo-generator by a 6250-kw., 60-cycle unit was recently completed in somewhat less than two months by the Rockford (Ill.) Electric Company. To make this possible it was necessary to devise special construction schemes. Speed was necessary for the reason that the station was well loaded with one 4000-kw. and two 2000-kw. units all in service. In closing down one of the 2000-kw. turbines while installing the new 6250-kw. unit in its place, therefore, extra load was thrown on the other machines.

Before shutting down the old unit, the concrete foundation was all bored for dynamiting and all other work done that was possible. It took one week to remove the turbine and three weeks to take out the old foundation, requiring the use of some 25 lb. of dynamite in small charges. To facilitate the excavation work, and later the removal of the concrete, a temporary narrow-gage track was laid from the turbine-room out to a dump on the river bank, some distance behind the power house. Two small tilting steel cars were used to carry away the excavated material. Two home-made trip bottom buckets of about 1-yd. capacity were handled by the turbine-room crane, and used to remove the excavated material and load it into the cars. It was necessary to excavate to a depth of 8 ft. below the floor level of the old foundation in order to get the proper setting for the new unit.

Concrete for the foundation of the new machine was mixed in a power mixer placed just outside the turbine-room door and dumped from the mixer into the small steel cars, which were run on the temporary track to the excavation, and the contents poured by trough to the bottom of the pit. The use of this special equipment for handling the work greatly facilitated the speed with which the work was accomplished. The removal of the 2000-kw., 25-cycle unit leaves in this station only 60-cycle equipment.

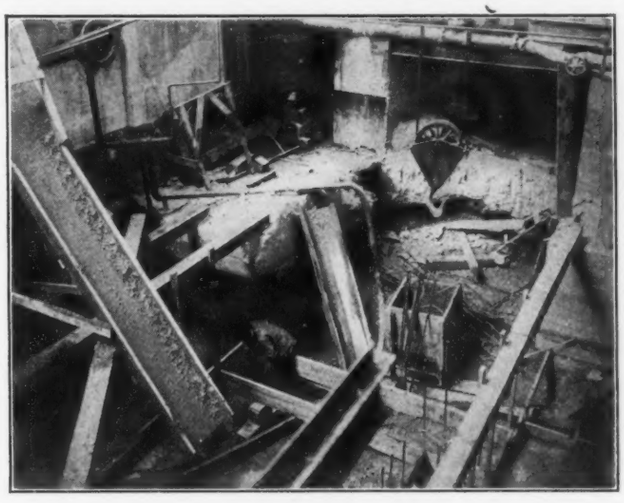


FIG. 1—EXCAVATION PREPARED FOR 6250-KW. TURBINE FOUNDATION

Troughs through which concrete was poured from small cars above are shown on the left. Below the hoisting hook is one of the home-made trip-bottom buckets which was used for removing materials.

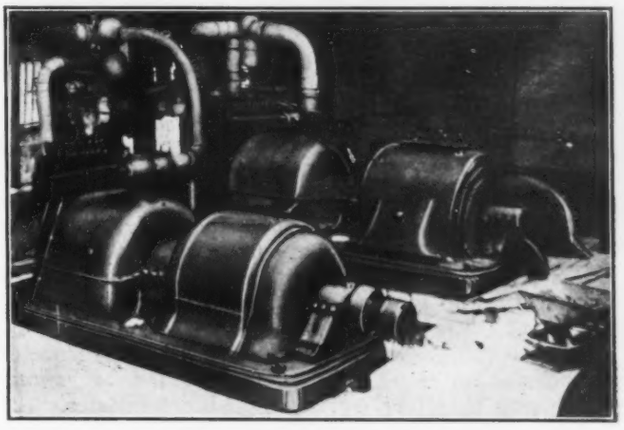


FIG. 2—VIEW OF GENERATOR ROOM SHOWING NEW TURBO UNIT

## Operating Conditions with Grounded Neutrals in Chicago

A grounded neutral system has been operated in the city of Chicago with satisfaction for the past fifteen years. At the recent Cleveland, Ohio, A. I. E. E. convention, Peter Junkersfeld, assistant to the vice-president of the Commonwealth Edison Company, gave the mileage of cable and conductor operated with grounded neutral in Chicago as follows:

| | Voltage | Miles |
|---|---|---|
| 25-cycle, three-phase, underground | 9,000 | 485 |
| 25-cycle, three-phase, underground | 20,000 | 82 |
| 60-cycle, three-phase, underground | 12,000 | 158 |
| 60-cycle, underground (single conductor equivalent) | 2,300/4,000 | 1,518 |
| 60-cycle, overhead (single conductor equivalent) | 2,300/4,000 | 7,850 |

The 25-cycle, 9000-volt system is divided into four sections so connected with the generators that not more than 80,000 kw. in equipment is joined to the largest section. Three of the sections are interconnected by tie lines and protective reactors. The fourth section, however is joined to the system by an 8.3-mile tie line without reactors. The practice is to have the neutral of one turbo-generator of each of the four sections grounded through iron-grid rheostats having a resistance of 2.5 ohms. One of these rheostats is provided for each system section and is connected between the ground and a neutral bus which can be connected by means of an oil circuit breaker to the neutral of any turbo-generator of a system section. The energy for the 2000-volt, 25-cycle system is supplied by three 5000-

kw., three-phase transformers stepping up from 9000 volts to 20,000 volts. The primary is delta connected and the secondary is star connected, with the neutral of all three transformers grounded solid. The 2300/4000-volt, 60-cycle system is supplied by 25-cycle to 60-cycle frequency changers and 12000-volt to 4000-volt, three-phase transformers. The transformers are delta connected on the primary and star connected on the secondary side. The neutrals of the 60-cycle generators of the frequency changers are all connected solid to the ground, and the neutrals of all the transformers are also connected in this manner. The neutral of the 12,000-volt, 60-cycle turbo-generators are grounded in the same manner as the 25-cycle machines, but the rheostats have a resistance of 3.0 ohms.

Experience with the grounded neutral has shown that it (1) insures prompt automatic disconnection of faulty feeders; (2) prevents existence of delta voltage to ground on other lines and apparatus in case of ground on any part of the system; (3) helps in locating breakdowns of lines and apparatus, and (4) prevents arcing grounds and voltage disturbance.

Under other conditions Mr. Junkersfeld mentioned that it may not be advisable to ground the neutral. For instance extensive inquiry a few years ago on grounding the neutral on a 33,000-volt overhead system serving towns and cities in Illinois, showed it advisable to adopt a delta-connected system without grounded neutrals except in special cases where it might later prove to be advisable. The reasons for this decision were as follows: (1) The distribution system was a four-wire, 2300/4000-volt layout which required star-connected secondaries on step-down transformers; delta connections were, therefore, advisable on the primaries. (2) Due to consolidation, it was necessary to operate a number of properties in parallel. Because of the phase relations it was found advantageous to have the step-up transformers at the generating stations star-connected on the primary and delta-connected on the secondary. (3) Furthermore, with ungrounded neutral the system could be operated in an emergency, with one phase wire grounded.

## Schemes That Facilitate Operation of Electric Excavators

Some unusual and interesting schemes have been developed in connection with the utilization of energy for operating excavators in the Little River Drainage District near Cape Girardeau, Mo. The excavators which were described in the ELECTRICAL WORLD of April 10, 1915, are being used to construct a 30-mile diversion channel and levees along the system. When the project was first started each excavator was supplied with energy from two 100-kw. transformers carried on wide-tired trucks alongside a transmission line paralleling the channel route. Wet and muddy paths that hindered moving the trucks were encountered so frequently, however, that it was decided to transport the transformers on small barges like the one shown herewith. They were built on the job at an expense of approximately $100 each. As indicated the high-tension lines leading to the barge are held above the ground and at the proper distance apart by insulators attached to the top of extensions to the barge-railing posts. The vertical jumpers connecting these lines with the transformers are supported at intermediate points by insulators attached to a short cross-arm and to the barge railing. To permit moving the transformer barge without adjusting the branch-line tap each time, it is connected with the line by an ingenious roller-contact device. It consists of two ordinary sash pulleys attached to a piece of sheet steel bent to form a rider similar to a barn-door hanger. From the rider is suspended an insulator attached to a rope which is employed to move the rider along the line when the barge is moved. When the end of a span is reached the transmission line is de-energized long enough to permit setting the rider on the adjacent span in the direction of excavation.

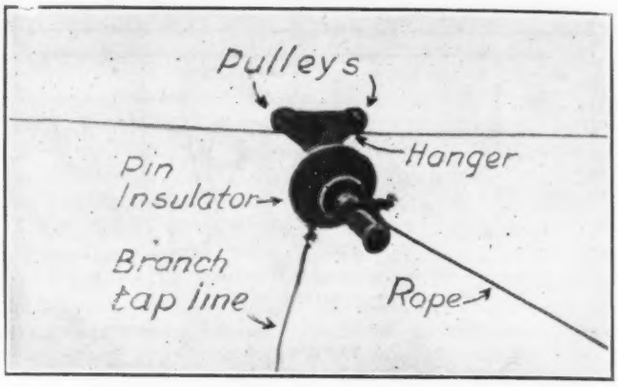



FIG. 2—TRANSMISSION-LINE RIDER FURNISHING MOVABLE TAP FOR EXCAVATION-WORK BRANCH LINE

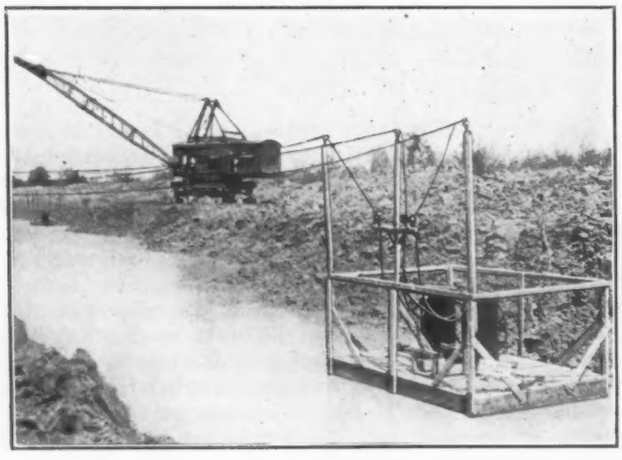


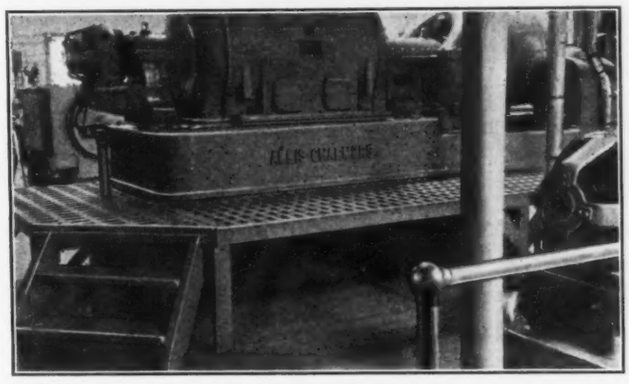
FIG. 1—BARGE THAT FACILITATES TRANSPORTATION OF EXCAVATOR TRANSFORMERS

FIG. 3—SHOVEL HANDLE FITTED WITH HOOK FOR SHIFTING 440-VOLT CABLES FEEDING EXCAVATOR

Energy at the voltage required for operating the excavator motors is conducted from the transformers to the machines through these 750,000-circ. mil flexible insulated cables. Since these are allowed to lie on the earth between the barge and the excavator they have to be dragged on the ground when the excavator is moved. To facilitate performing this operation without receiving shocks through insulation which may be worn thin, shovel handles are provided with hooks bolted to the end. On one of the dredges, electric fans have been used with satisfactory effects in the daytime to keep mosquitos from annoying the operators. At night, however, the damp drafts produced by the fans are almost as unbearable as the mosquitos.

## Construction for Removable Turbine Platform

At the Grand Haven (Mich.) electric light plant an idea has been borrowed from the big lake boats and a slatted operating platform built around the 500-kw. condensing turbo-generator just installed. The platform is made of 2-in. by 4-in. pine underpinning and sills and 1.5-in. by 0.875-in. pine slats. Where fastening is necessary its sections are held together with nails. The chief reason for adopting the slatted construction was



REMOVABLE WOOD PLATFORM AROUND TURBINE IN MICHIGAN STATION

that it made a light and sightly platform which can be easily moved away from the unit to facilitate cleaning, painting or repairs. The occasions for such removals are said to be frequent in this station on account of the fact that the apparatus is kept in "shipshape" by regular applications of light blue paint to machine frames and gray paint to the floor and walls. The platform will be completed by the addition of a metal railing. Its cost was approximately $15, which is inconsiderable in comparison with the total cost of the new unit installed at $16,000.

## Systematic Method of Cleaning Manholes

One large electric service company has adopted methods for cleaning manholes that makes it possible to attend to a relatively large number in any period, the expense being about 37 cents per manhole or $1.95 per cubic yard of refuse removed. According to the N. E. L. A. underground construction committee's report, the company employs for this purpose a two-horse dump wagon of 2-yd. capacity, a gang of four or six men and a foreman. The greater part of the work is done during the winter season when conduit laborers are least employed and when the refuse is least offensive to remove. The gang is divided into pairs which work along a street removing the mud from manholes and piling it near the curb. Each group loads the material nearest it into the dump wagon but resumes cleaning the manholes while the wagon is driven to the dump and returned. In the business district, manhole cleaning is done on Sundays and on other days the work is confined to the outlying districts, so there is not much interference with traffic. Furthermore, the complaints due to piling dirt along the curb are fewer. When underground cables must be pulled or when there are other operations to be performed in the manholes the cleaning gang is sent around in advance of the construction gang.

This work keeps the cleaning gang busy about one-third to one-half of the time during the summer months. During the rest of the time the men are distributed among several gangs that install conduits and laterals. With these arrangements the men work at a better "load factor" and the unit cost of cleaning manholes is about 65 per cent less than formerly. Furthermore, 28 per cent more manholes are cleaned per year at 55 per cent less expense.

## Conductor Joints That Prevent Syphoning

BY R. L. ELKIN

Annoyance is often caused by oil from oil-filled apparatus, such as feeder induction regulators, reactances for rotary converters, etc., creeping or oozing along the cable and over the terminals. This creeping and seeping along the conductor is due to a syphoning action and capillary attraction between the strands and insulation, and any serious attempt to prevent it must overcome this phenomena. The creepage of oil in this way is undesirable because it usually results in stickiness and

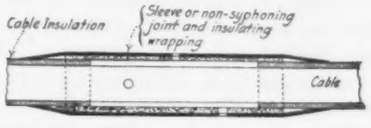



FIG. 1—NON-SYPHONING JOINT SHOWING SLEEVE AND INSULATING WRAPPING

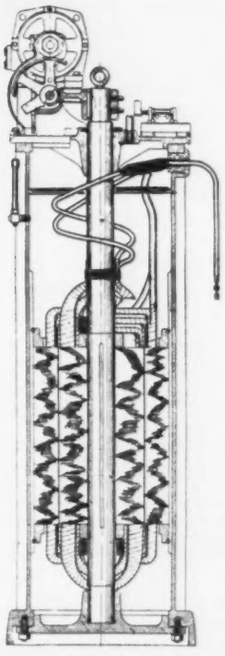


FIG. 2—NON-SYPHONING JOINTS ON REGULATOR TERMINALS

the collection of dirt and dust on the oily parts and in stained floors. Moreover, it is very objectionable because of the deleterious influence on the mechanical and insulating properties of certain materials insulating the leads.

An old method, and one that is usually satisfactory for preventing the above action, is to cut back the insulation on the conductor above the oil, and solder the strands together. Another method that is being used at the present time with satisfactory results is a modification of the above in that, in addition to the solder, an air gap is introduced between the insulation above and below the soldered strands. The insulation is cut back about 4 in. or 5 in., and the intervening strands soldered together. A sleeve of insulating material in which two or three small holes about $\frac{1}{8}$ in. are drilled is then slipped or fastened over the soldered portion of the cable, where it is fixed in place by wrapping empire cloth or tape round it. The whole is then insulated according to the voltage at which the circuit operates. It is advisable not to cover the holes in the sleeve with insulating material, and it is preferable to have at least one hole pointing in a downward direction.

# COMMERCIAL AND BUSINESS POLICY

*A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service*

## An Electric Café in the Buffalo Electric Company's Tower

BY E. D. O'DEA

High up on the breeze-swept fourteenth floor of the tower of the Buffalo General Electric Company's building, the American Red Cross Society is conducting a café and tea room, the proceeds of which are to be used for the alleviation of suffering among the wounded European soldiers. The café is proving extremely popular, an average of between 200 and 300 persons a day being served. Beautiful views of the city are obtained, and even on the hottest summer days a cool breeze always stirs.

All heating and cooking in the new restaurant is done by electricity. A No. 50 Hughes heavy-duty range performs the bulk of the work. Several two-burner hot plates, a Simplex plate-warmer and a General Electric oven are also utilized.

Many downtown business men and women and well-known society people patronize the café regularly. The installation is a most effective electric-cooking demonstration and is proving a valuable advertisement.

The room together with the entire electric equipment and the electrical energy itself have all been donated by the Buffalo General Electric Company through the courtesy of C. R. Huntley, George Urban, Jr., and H. L. Mann.

## How Customers Outside Village Limits Pay for Line Extensions to Gain Electric Service

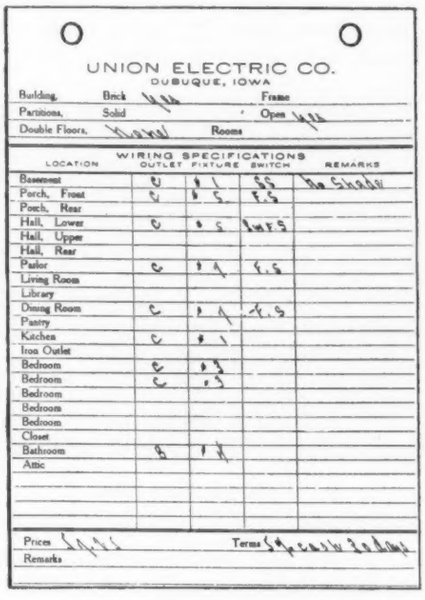
Many applications for service come to the municipal lighting plant at Downers Grove, Ill., from people living outside the corporate limits of the village. It is considered hardly fair to the residents and taxpayers of the village to extend the lines outside the corporate limits in order to provide service to customers paying no taxes, and yet these customers represent a good source of revenue. The situation has however, been satisfactorily handled by H. A. Gardner, manager of the village lighting department, by having these customers advance the money for building the extension required.

In the case of an extension costing, say, $150, to serve six customers wanting service, each customer would be asked to pay $25 cash to Mr. Gardner, who would then proceed to build the line and furnish service, afterward rebating these customers every other lighting bill until the $25 was turned back to each customer.

This is thought to be a better plan than to make the customer sign a long-term contract, for by the rebate method the money is provided and the utility does not have to finance the work and yet is sure of the customer at least until the investment is rebated. And while the line is being paid for through the rebates, the utility realizes half-rate revenue and owns the line at the end. During 1915 seventy new customers were obtained by this procedure, and these represent a very desirable additional revenue to the local lighting department.

## Keeping Actual Count of New House-Wiring Possibilities

In order to have definite knowledge at all times of the exact number of houses in Dubuque, Iowa, which are not wired for electric service, the Union Electric Company of Dubuque has adopted a plan of record whereby the management can quickly determine just how many possibilities there are to work on, and thus can direct and check the work of the salesmen to better advantage. For this purpose the names of all the streets in each of the four districts into which the city is divided—one for each salesman—are written in a house-wiring record


UNION ELECTRIC CO.
DUBUQUE, IOWA

Building, Brick, Frame
Partitions, Solid, Open
Double Floors, Rooms

WIRING SPECIFICATIONS

| LOCATION | OUTLET | FIXTURE | SWITCH | REMARKS |
|---|---|---|---|---|
| Basement | | | | |
| Porch, Front | | | | |
| Porch, Rear | | | | |
| Hall, Lower | | | | |
| Hall, Upper | | | | |
| Hall, Rear | | | | |
| Parlor | | | | |
| Living Room | | | | |
| Library | | | | |
| Dining Room | | | | |
| Pantry | | | | |
| Kitchen | | | | |
| Iron Outlet | | | | |
| Bedroom | | | | |
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| Bedroom | | | | |
| Bedroom | | | | |
| Bedroom | | | | |
| Closet | | | | |
| Bathroom | | | | |
| Attic | | | | |

Prices, Terms
Remarks

LOOSE-LEAF FORM FOR RECORDING DATA CONCERNING PRESENT AND PROSPECTIVE CUSTOMERS

book, and after each name the number of possible customers whose homes are not wired on that street. Then as the "meter set" reports come through the office each day a mark is made after the proper street names, the list of unwired houses being thus revised and kept up to date. The totals for each street are brought forward from time to time by deducting the number of marks appearing after each, and the new grand total of unwired houses is simply had by adding up the corrected individual totals.

In addition, a card, such as is shown herewith, is kept for each possible new customer, and on this a record is kept of the method of lighting and character of service for cooking and ironing, besides other details. The salesmen make notations on these cards after "remarks" of the results of each of their calls. Then when the order is finally secured, the salesman makes his estimate of the fixtures, etc., required, and the cost, and fills it in on the form provided on the back of the same card as shown. These cards are date-filed between calls of the salesmen to come up again, so that all possible customers are visited four times a year.

Keeping the record is a simple matter, but it re-

quired considerable time to get the correct list in the first place. The names of the company's customers were crossed off the geographical list in the back of the city directory, and the remaining names were checked by the personal calls of the salesmen. The result is an absolute record of every possible customer in the city, so that it is possible to concentrate on sending advertising literature and house-wiring and electric-service data to exactly those people whom it is desired to reach.

## HANDLING CUSTOMER CREDITS

### The Liberal Policy of the Detroit Edison Company as Described Before the Michigan Section N. E. L. A.

BY ROBERT R. BROWN

Credit methods and facilities employed in Detroit have proved without doubt the best solution of giving prompt service to customers of the Detroit Edison Company, as well as safeguarding the company against the man who would try to evade the payment of an old account. The system is the outgrowth of necessity and of many years of experience. It was comparatively easy to check up delinquent customers when the company had only a few hundred accounts, but as business rapidly expanded it was necessary to devise some system to save time. It is now possible to ascertain a customer's delinquency without referring to ledgers.

As accounts are charged to "uncollectible," a record card showing the name, address and the amount so charged off is filed alphabetically in a credit desk. This desk, operated on the Library Bureau system, will hold 35,000 such cards. A daily record is also kept of delinquent customers. These cards are placed with the uncollectible cards.

#### How a Credit Rating Is Quickly Obtained

When an application for service is taken from a customer the clerk passes this application to the credit desk and it is there checked with reference to "uncollectible" accounts and "slow payment." In case an uncollectible account is found against a prospective customer it is immediately called to his attention and a settlement is requested prior to giving service. In case he has been slow in payments the matter is talked over carefully with him and it is suggested that he discount his bills in the future. If he has been *very* slow it is insisted that he furnish a written agreement for a deposit upon his failure to discount future bills. The percentage of applications on which the company takes security is very small, especially on residence contracts. Commercial contracts are treated differently, however, for the reason that the company is there taking a greater risk, particularly with certain classes of business, which necessitates asking for security. For instance the company requires security from customers in the foreign districts where there is such close similarity in names; also from businesses that are not of a permanent nature, sometimes termed "fly-by-nights."

#### A Month's Work in the Credit Department

A few figures showing what happened during May, 1916, are interesting. The total number of contracts checked for credit was 7813. Of this number deposits were secured from 803 and 532 were guaranteed accounts. A total of 2313 applications were passed without security, as these applicants claimed to own property. References had been furnished by 4165, or they had been former customers with good records. Thus it will be readily seen that the company requires security on only a very small percentage of its contracts and that there are very few "dead-beats" in Detroit, the "City Where Life Is Worth Living."

#### Liberal Policy on Credits

Deposits are often refunded in view of the fact that the customer has been found prompt with his payments. As may be noted, 2313 customers were accepted on their claim that they owned property in the county. The company verifies these statements of ownership in the case of commercial accounts only, and in the event it finds that they do not own the property specified a rep-

## Lake Spaulding as a Vacation Camp for Pacific Gas & Electric Employees

Lake Spaulding, the great mountain reservoir of the hydraulic system of the Pacific Gas & Electric Company serving San Francisco, has become the Mecca of many sportsmen and pleasure-seekers. During the 1915 season this haunt in the wilds of the snow-capped Sierras was thrown open for the enjoyment of the company's employees and the public. The offices and cottages formerly occupied by the engineers during the construction of the huge Spaulding dam were leased for hotel purposes. At this hotel sections are reserved for the company's employees, who can obtain food and lodging at very low prices. During last summer and fall many employees took advantage of this opportunity to obtain a vacation in the pure mountain air without the inconveniences of camping, and at a low cost. The lake furnishes a good fishing ground, and game is abundant in the nearby mountains throughout the year. A magnificent view of the winding South Yuba canyon and of the snow-topped peaks of the Sierras is obtained from the site of the camp.

resentative calls upon the customer and either gets security or finds out if the equity owned in the property is sufficient to warrant extending a reasonable amount of credit.

### References Accepted

Prospective customers offering references as security are accepted in great numbers. The company subscribes to the Commercial Credit company, which gets in touch with the people referred to and sends a written report. In case a customer has had an account at one address and has paid his bills promptly, the company does not ask him for further security, but takes him on that record. In case a guarantor withdraws his guarantee from an account, the first thing the company does is to ascertain whether or not continuing security is necessary. If the account has been frequently delinquent the company writes the customer requiring a new guarantor or a deposit. As a matter of policy the company is lenient in extending credit. In taking new residence applications the customer is informed that so long as his bills are paid promptly security will not be required to insure the payment of his bills. This is an incentive to him to pay his bills promptly and it works out to his and the company's mutual benefit.

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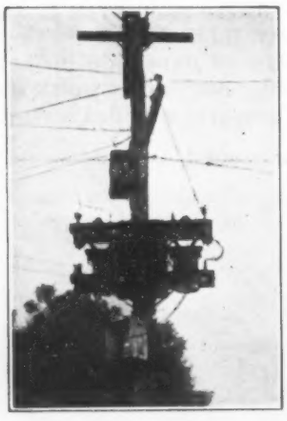
## How Carnival Shows and Other Temporary Customers Are Handled at Dixon, Ill.

When a carnival or a tent show comes to the average town nowadays, the traveling showmen usually expect to secure lighting service and sometimes motor service from the local central station. The Illinois Northern Utilities Company of Dixon, Ill., upon receiving application for such service, unless the carnival is backed by a local organization, accepts a deposit to cover "time and material" on the transformer and service installation, and the estimated energy consumption at the company's regular rates. An order is then issued for the work.



TEMPORARY CARNIVAL INSTALLATION AT DIXON

In commenting on a recent job of this character Charles B. Yontz, the company's general contract agent, said: "We are sometimes 'put to it' to secure transformers quickly enough if we do not happen to have one of proper size in stock in the town where temporary service is desired. But by shifting units in the large territory the company serves, we are always able to secure transformers without great inconvenience to the operating department. The average bill for energy for a one-week stand of a carnival is about $50."

The installation pictured herewith, consisting of one 15-kw. and three 5-kw. transformers, was erected to serve a Moose carnival with a connected load of 700 50-watt equivalents. The cost of the installation, as ascertained by G. C. Spencer, engineer of distribution, was $59.58. This expense included the use, hanging and delivery of transformers and meters and their subsequent removal, and the running of service wires. As will be noted from the illustration, the meters are installed in pine storeboxes to afford them some protection from the weather.

# *Wiring and Illumination*

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

## Reflector Units for Tennis-Court Lighting Arranged for Lowering

THE TENNIS COURT LIGHTED FOR NIGHT PLAYING BY FOUR 1000-WATT GAS-FILLED LAMPS

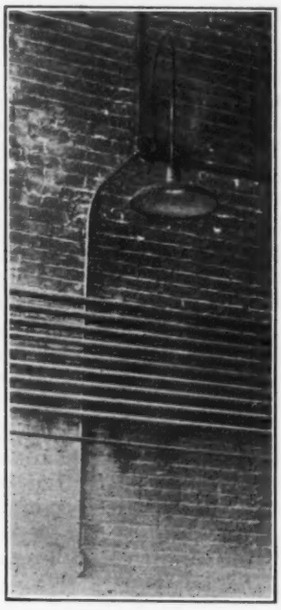
The Mill Valley (Cal.) tennis courts pictured herewith are lighted by four 1000-watt Edison Mazda gas-filled lamps equipped with Ivanhoe reflectors, equally spaced over the center of the court at a height of 30 ft. above the ground. The units are supported from a 5/16-in. galvanized-steel messenger cable anchored to trees at the ends of the court. Service is carried to the four units by means of a No. 10 B. & S. triple-conductor, lead-covered cable strung from the steel messenger cable, as shown in the day view photograph. One end of the messenger cable is attached to the tree through a block and tackle, which affords a ready means of lowering the units to the ground for replacements and for cleaning. The installation is a marked success, and players assert that they can play as good a game under this lighting as by daylight.

LAMPS AND REFLECTORS ARE SUSPENDED FROM CABLES AND CAN BE LOWERED FOR REPLACEMENT AND CLEANING

## MAKING WIRING SYSTEM FLEXIBLE

### Adapting a Conduit System in an Industrial Plant to Provide for Changes in Machine Locations

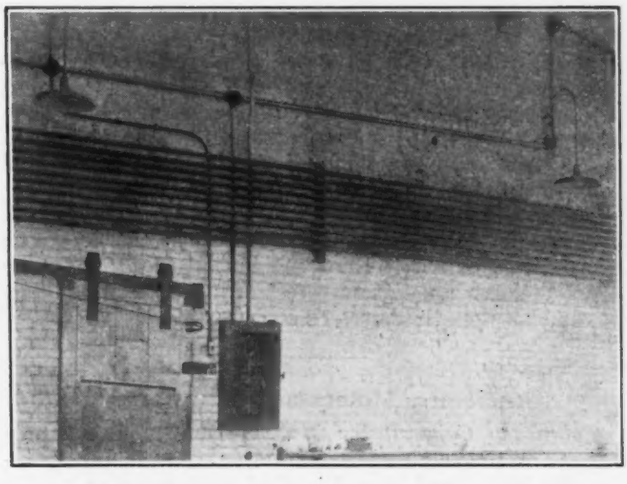
A wiring system neatly housed in a well-laid-out conduit system is all sufficient from the standpoint of safety, but looking at such an installation in view of future extensions introduces another and very important consideration, especially in industrial plants. In such installations, where many machines are used, there are very frequently occasional shiftings of the location of the machine units, and this means that new lighting units must be installed and sometimes new motor leads run, and both tapped into their respective conduit main runs. If no provision has been made for these added lamps or branches, it will be an expensive piece of work to cut into the conduit system and open the circuit to insert a new T-fitting.



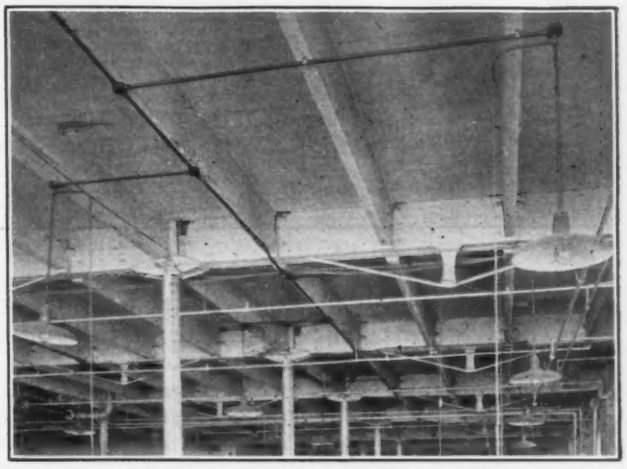
LAMP AND SWITCH EXTENTIONS CARRIED FROM EXISTING BOX

The Rumely Company, at La Porte, Ind., has provided for such alterations in layout and for new extensions to the system in its more recent wiring installations by the use of Adapti boxes. No attempt was made to predict when future outlets to the conduit system would be needed, so that the outlet boxes installed at such points were simply the boxes required in the original layout. With the fittings used, however, it has been possible to run branch lines in practically any direction from one of the existing boxes by substituting a proper outlet fitting for the side cover on the box, and without disturbing the original conduit or wiring. The substituted fitting may also serve as the union between 1-in. or 2-in. conduit and any smaller size for the branch run. The accompanying photographs show a few of the combinations which have been resorted to in this extension work.

By this means a most flexible conduit system is secured, and yet the original cost of the installation is kept at a minimum, since no special boxes need be installed for future possible requirements. Also, the size of conduit for any branch run need comply with present requirements only, and can be installed regardless of the size of the main conduit run, since the reducing outlet fittings make up for any of the standard sizes which are supplied and carried on hand to fit any size of box.



LAMPS ADDED AFTER COMPLETION OF CONDUIT WIRING SYSTEM



CONDUIT SYSTEM IN THE OFFICE—FUTURE DROPS CAN BE EASILY RUN FROM THE EXISTING BOXES

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## A Police Station Sign that Commands Attention

In order clearly to indicate the location of police headquarters on the Boulevard fronting the beach at Revere, Mass., the Metropolitan Park Commission has installed a 1000-cp. nitrogen-filed incandescent lamp in a ground-glass lantern bearing on two faces the word "Police." The large lamp makes the lantern conspicuous even on this avenue of brightly-lighted shops and pavilions, enabling it to be seen from any point on the boulevard, which is about 3 miles in length.

DOOR LANTERN OF THE REVERE (MASS.) POLICE STATION

# ADVANCE IN TECHNICAL THEORY AND PRACTICE

*Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World*

## COLOR PHOTOMETRY

### An Inter-Laboratory Photometric Comparison of Glass Screens and of Tungsten Lamps, Involving Color Differences

SINCE the establishment of the international candle in 1909 this unit has been maintained at the Bureau of Standards in Washington solely by means of a group of 4-w.p.c. carbon-filament incandescent lamps. With the advent of the tungsten lamps there was introduced into standardization work the difficulty of comparing lights of different colors, and at once it became desirable to have the unit well established also in tungsten lamps operated at or near their normal color.

In 1911, by common agreement between the National Physical Laboratory of England and the Bureau of Standards, each laboratory prepared a group of tungsten standards calibrated for voltage corresponding to approximately 1.5 w.p.c. These two groups of lamps, which were thus operated at very approximately the same color, were then exchanged, and each group was remeasured by the receiving laboratory at the voltage determined by the sending laboratory. A group, similar to the one sent to England, and standardized in the same series of measurements, was retained at the bureau, and half of the group received from England, after measurement was returned for remeasurement.

In view of the difficulties involved in the intercomparison, the result was very satisfactory, as it showed that the two laboratories were in agreement to within the indicated precision of the measurements. In both laboratories the new standards were measured by means of Lummer-Brodhun contrast photometers of the standard type, and in terms of similar groups of 4-w.p.c. carbon standards, the English laboratory having made the comparison by the cascade method, the Bureau of Standards by the use of two calibrated blue glass screens, each of which produce a color match between the two groups of standards compared. It is obvious, therefore, that the calibration of the glass screens used by the bureau in this intercomparison was a matter of prime importance, and for this reason a large amount of work has been done in checking, by various methods, the values first assigned.

In connection with these check measurements, and after a determination of the candle-power and current of a group of tungsten substandards at several voltages had been made, and this followed by a further investigation of other groups of tungsten lamps, the voltage-current-candle-power curves were determined and accurately expressed by means of equations. It was found that by employing these equations it is possible to measure tungsten lamps in color match with 4-w.p.c. carbon standards and compute with accuracy their value at any other color within the range investigated. In this way, as well as by direct comparisons, the new tungsten standards have been rechecked a number of times by different groups of observers.

These equations have an important application also in the life testing of tungsten lamps, because in some testing laboratories it is customary to photometer the lamps at or near rated voltage and compute the voltage corresponding to the efficiency at which it is desired to burn the lamps on life test.

In the establishment of the 1.5-w.p.c. tungsten standards, and also in the determination of the characteristic equations, the photometric measurements of necessity involved color differences. Although numerous check measurements have been made and the results have been very satisfactory, it is, of course, realized that if some other group of observers had made these measurements the values obtained might have been different.

It was, therefore, suggested that an inter-laboratory photometric comparison of lights involving color differences such as those encountered in these measurements would yield valuable information not only as to the agreement which might be reasonably expected among different groups of experienced observers, but also information as to the merits of different methods of making such measurements.

The Bureau of Standards, therefore, in May, 1914, invited several of the more important photometric laboratories of the country to co-operate with it in making measurements of this kind. The Nela Research Laboratory, the Electrical Testing Laboratories and the Physical Laboratory of the United Gas Improvement Company accepted this invitation, and the results of this very interesting co-operative research are given in Scientific Paper 277 of the Bureau of Standards, entitled "An Inter-Laboratory Photometric Comparison of Glass Screens and of Tungsten Lamps, Involving Color Differences," by G. W. Middlekauff and J. F. Skogland. As to the detailed results of these tests the reader must be referred to the tables and diagrams in the original bulletin.

The most interesting general and quite conclusive result of this intercomparison is that in each laboratory, regardless of the kind of photometer used, even though a considerable color difference was involved, each observer maintained a fairly constant criterion with respect to the mean. The same is true of each laboratory in respect to its relation to the mean of all, as judged by the measurements on the glass screens and those made on the lamps some months afterward.

Considering the difficulties involved in the measurements, the different characteristics of observers and the wide difference in illumination employed, covering probably a range of ten times, the agreement among the laboratories is remarkably good.

It is evident, threfore, that measurements to establish standards involving a color difference should be left as much as possible to the standardizing laboratory, where the observers must be carefully selected and a considerable number employed and the instruments and conditions of illumination, etc., definitely fixed.

An examination of the bureau's observers who took part in this work shows that their mean characteristic is very approximately the same as that of the "average eye," as determined from a test of 114 observers taken at random from the bureau's scientific staff.

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## Generators, Motors and Transformers

*Polyphase Commutator Motor.*—ROBERT MOSER.—In a paper on the polyphase commutator shunt-motor, Dreyfus and Hillebrand have described some peculiar results obtained with tests of polyphase commutator machines

with short-circuited brushes. According to the usual theory, assuming sinusoidal fields, these machines should behave exactly like a commutatorless polyphase motor with short-circuited armature. The authors found, however, that in the circular diagram for the commutator motor the center of the circle is below the axis of abscissas, resulting in a poorer power factor and a smaller overload capacity. Dreyfus and Hillebrand believed that the explanation was to be found in the existence of a secondary additional stray field in the commutator motor. On the other hand, Heyland has described remarkable results obtained with a polyphase commutator motor with short-circuited brushes (called by him polyphase repulsion motor), which differs from the ordinary motor only in details of the type of winding. With his motor Heyland obtained an improved power factor, and for a certain arrangement and position of the brushes he could obtain even unity power factor. If Dreyfus and Hillebrand's hypothesis was correct, he should have obtained a poorer power factor. The present paper, which is of a mathematical character, endeavors to find an explanation of these discrepancies. The attempt is made to investigate whether the peculiar behavior of ordinary commutator motors with short-circuited brushes may not be due to the same causes which make the difference between the Heyland motor and the ordinary commutator motor. This difference is to be found in the shapes of the fields produced by the stator and rotor windings. The paper is to be continued.—*Elek. u. Masch.* (Vienna), March 26, 1916.

## Installations, Systems and Appliances

*Manchester Electrical Supply.*—An abstract of the last annual report of the municipal electric station of Manchester. The energy sold exceeded 141,000,000 kw.-hr., an increase of 14,000,000; the items were: Private consumers, 113,300,000; traction, 28,100,000.

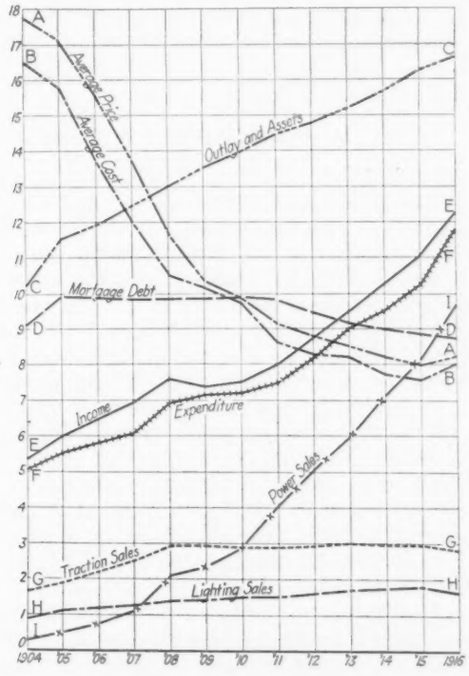



FIG. 1—CHART SHOWING THE DEVELOPMENTS IN MANCHESTER (ENGLAND) ELECTRIC-SERVICE BUSINESS

The energy used on works amounted to 13,100,000, and that used in distribution, etc., to 26,700,000, the total quantity generated being 181,300,000, compared with 162,700,000 in 1914-1915. The maximum demand was for lighting and power, 42,976 kw.; for traction, 10,000 kw.; total, 52,976 kw., compared with 50,460 kw. in 1914-1915. The average price obtained per unit was 2.06 cents. The curves given in Fig. 1 show the development of the station from 1904 to 1916. For curves *A* (average price) and *B* (average cost) the scale unit is 0.25 cent. For curves *C* (outlay and assets) and *D* (mortgage debts) the scale unit is $1,000,000. For curves *E* (income) and *F* (expenditure) the scale unit is $250,000. For curves *G* (traction sales), *H* (lighting sales), and *I* (power sales) the unit is 10,000,000 kw.-hr.—London *Elec. Review*, June 16, 1916.

*Kilmarnock.*—The first part of an illustrated description of recent extensions of the municipal electric station of Kilmarnock. Up to a few years ago the largest consumer was the municipal tramway, while 90 per cent of the mills and engineering works in Kilmarnock were also connected to the station. Now the area of supply has been extended so as to include the burghs of Troon, Irvine, Glaston, Newmilns and Darvel, and a few villages and parishes; the whole area covers approximately 160 square miles, Kilmarnock being situated in the center. In order to meet the new conditions efficiently, a three-phase, high-tension supply has been introduced, and the various localities are now linked up to Kilmarnock. An 11,000-volt overhead transmission system has been adopted. The whole of the transmission line is designed for 20,000 volts, but is only working at 11,000 volts at present. Immediately on the boundary of the burgh of Troon a substation is erected where the pressure is reduced to 3300 volts. For direct-current supply where this is needed converters are installed. The article is to be continued.—London *Elec. Review*, June 16, 1916.

## Wires, Wiring and Conduits

*Line Insulators.*—R. V. PICOU.—An illustrated paper read before the International Society of Electricians in Paris, in which the author recommends standardization of line insulators and proposes certain standard dimensions.—*Bulletin de la Soc. Int. des Elec.*, 14, Ser., Vol. VI, page 39; *La Revue, Elec.*, May 5, 1916.

*Protective Relays.*—L. N. CRICHTON.—An illustrated discussion of the use of protective relays on alternating-current transmissions. The subject is discussed under the following headings: Sectionalizing of transmission lines; calculation of the short-circuit current; relay accuracy; effect of unbalanced short-circuits; the protection of apparatus; the details of relay construction. —*Elec. Journal*, July, 1916.

*Feeder Voltage Regulators.*—E. E. LEHR and I. C. MINICK.—An illustrated article on induction-type feeder regulators, their advantages and methods of operation. The latest regulators are automatically controlled by means of a voltage-regulating primary relay and an electrically operated motor switch commonly called an auxiliary or secondary relay. A line drop compensator with the necessary current transformer, and a voltage transformer for reducing the line voltage to a value suitable for the primary relay, are the accessories normally required for automatic operation. Different wiring diagrams of automatic regulators are given.—*Elec. Journal*, July, 1916.

## Electrochemistry and Batteries

*Electrochemical Possibilities of the Pacific Coast.*—J. W. BECKMAN.—A critical comparison of the conditions of the Pacific Coast and those of Sweden and Norway. The author concludes that the prospects of electrochemical industries on the Pacific Coast are excellent, and that the Pacific Coast has more potential wealth in its 11,000,000 hp., of which 93 per cent now goes to waste, than all the gold that has been mined and yet is to be mined in those States. But an export trade by boat to the south and west from the Pacific Coast must

be created. With respect to this subject there is also an editorial on the place value of water-powers of the Pacific Coast for electrochemical industries.—*Met. & Chem. Eng'ing*, July 1, 1916.

### Units, Measurements and Instruments

*Phosphoroscope.*—E. L. NICHOLS and H. L. HOWES.—An American Physical Society paper describing the "synchronophosphoroscope" which the authors have developed for various studies in phosphorescence to which previous types of phosphoroscopes are not easily adaptable. It consists of a small synchronous, alternating-current motor, *AC*, Fig. 2, and a small direct-current motor, *DC*, upon a common shaft. To one end of the shaft is attached a sectored disk, *WW*, Figs. 2 and 3,

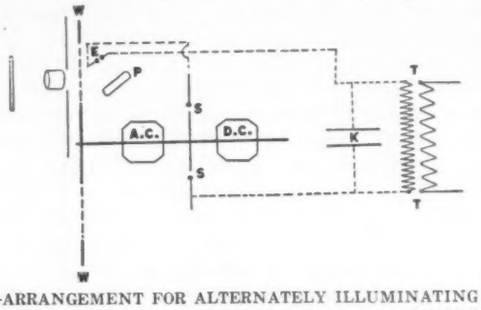



FIG. 2—ARRANGEMENT FOR ALTERNATELY ILLUMINATING PHOSPHORESCENT BODY AND EXPOSING IT FOR EXAMINATION

with four equal open and four closed sectors, corresponding to the four poles of the alternating-current motor. On a circuit of 60 cycles this machine, when brought to speed by the direct-current motor and released, runs steadily at 30 r.p.s. A step-up transformer, *TT*, in the same alternating-current circuit produces discharges at the spark gap, or series of gaps *E*, at each alternation, *i.e.*, 120 times a second. This discharge may be reduced to a single spark by proper adjustment of the resistance and capacity of the circuit, or more conveniently for many purposes, the discharge may be confined to the peak of the wave by means of the four-pointed star wheel, *SS*, Figs. 2 and 3, which is mounted on the shaft and carefully adjusted as to phase. The direct-current motor may also be used to drive the sectored disk at other speeds, in which case the circuit of the motor alternating-current is broken and the dis-

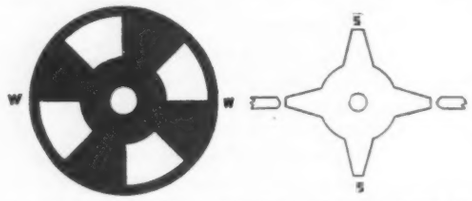



FIG. 3—SECTORED DISK AND STAR WHEEL USED WITH PHOSPHOROSCOPE

charge is derived from any convenient source capable of producing a proper spark at each quarter revolution. When the sectored disk *WW* is so adjusted on the shaft that the closed sectors conceal the phosphorescent surface during excitation by the spark, an observer, looking through the open sectors as they pass, sees the phosphorescence as it appears a few ten-thousands of a second after. The apparatus is thus suitable for the study of phosphorescence of very short duration or of the earliest stages in cases of slow decay. By shifting the sector on the shaft it is possible without variation in the rate of rotation to make observations at the very beginnings of phosphorescence and to compare by simultaneous vision the appearances, just before and immediately after the close of excitation, or, on the other hand, the earlier with the later stages, up to about 0.004 second. The photometer, spectroscope, spectrophotometer, camera, etc., may all readily be used with this form of phosphoroscope and studies of the most varied character become possible.—*Science*, June 30, 1916.

*American Nickel Steels of Low Thermal Expansivity.*—A. W. GRAY, D. H. SWEET and L. W. SCHAD.—An abstract of an American Physical Society paper. In order to assist American manufacturers in producing nickel steels of specified thermal expansivity combined with other desirable properties, the Bureau of Standards has co-operated with the Midvale Steel Company in an investigation of alloys containing about 36 per cent nickel. The expansivity was studied at many temperatures extending from about — 150 deg. C. to about 665 deg. C., and data were obtained that show effects of mechanical, thermal and magnetic treatments, as well as of slight variations in the constituents. The investigation has already resulted in the production of specimens which, as far as small expansivity is concerned, compare favorably with good French invar; but sufficient time has not yet elapsed to show how stable they can be made as regards length. In conformity with the experience of Guillaume it was found that cold-drawing and quenching lower somewhat the expansivity at room temperatures, while annealing raises it. Also, the curve representing the expansion on heating was found to lie above that representing the contraction on return to room temperature, in the case of a cold-drawn specimen, in which the relation was reversed. At any temperature, however, above that at which the alloy assumes ferromagnetic properties on cooling, the length was always found to be the same, whether the temperature in question was reached by warming or by cooling. At very low temperatures the expansion curve rises slowly with slight convexity upwards. At ordinary temperatures this convexity flattens out as the curve passes through a region of inflection that has a very gentle slope. In the neighborhood of 200 deg. C. the direction of curvature is reversed, giving place to a strong concavity upwards as ferromagnetism rapidly disappears. At higher temperatures the concavity is slight, but the slope is steep.—*Phys. Review*, June, 1916.

### Telegraphy, Telephony and Signals

*Crystal Detectors.*—VICTOR A. HUNE and LAURENS E. WHITTEMORE.—An illustrated account of tests of various crystal detectors used in wireless telegraphy when subjected to varying conditions of temperature, pressure and humidity. Galena, perikon, silicon and carborundum detectors were tested. Change in air pressure has no effect upon rectifiers. The effect of temperature is shown in a series of diagrams. One of the peculiarities noticed was that certain crystals did not always rectify the oscillating current in the same direction. With one adjustment the rectified current would flow from crystal to point and with another would flow in the opposite direction. Once during a test on the effect of change of temperature upon carborundum the rectification actually reversed, although no change had occurred in the adjustment. The most common direction of rectification for silicon and for galena was from the crystal to the brass point which was used. In the case of carborundum the ordinary sense of rectification was from needle to crystal. The perikon detector was the only one of the four which showed no reversal, always rectifying from chalcopyrite to zincite.—*Phys. Review*, May, 1916.

### Miscellaneous

*New Zealand.*—Tables showing the imports of electrical and allied goods into New Zealand in 1914 in comparison with 1913.—London *Elec. Review*, June 16, 1916.

PUTNAM A. BATES

# *Men of the Industry*

Changes in Personnel and Position— Biographical Notes

**Putnam A. Bates**, the new president of the New York Electrical Society, is a consulting engineer of New York City. Mr. Bates was two years ago appointed chief of the Bureau of Fire Alarm Telegraph for the city of New York, and devotes a part of his time to this work. He was graduated from Columbia University in 1897, and afterward engaged in manufacturing work for seven years, serving as an executive officer of the Crocker-Wheeler Company. Mr. Bates is well known in engineering circles in New York City. Among the plants designed by him are the equipment of the Engineers' Club in New York and that for the group of buildings at Hartford, Conn., erected by the late J. P. Morgan in memory of his father.

**Walter L. Mulligan**, manager of the United Electric Light Company of Springfield, Mass., has been appointed president of the Public Service Associates, succeeding Alfred E. Martin.

**H. S. Wilson**, who recently resigned as engineer and manager of the New England Engineering Company, Waterbury, Conn., has been appointed general manager of the Lane Manufacturing Company, of Waterbury.

**H. M. Kohn** has been appointed commercial manager of the Birmingham (Ala.) Railway, Light & Power Company. Mr. Kohn has conducted sales campaigns in a number of properties for the United Gas & Electric Engineering Corporation, which operates the Birmingham company.

**Edward A. Harris**, who has been local manager of the Malden (Mass.) Electric Company, which is controlled by Charles H. Tenney & Company of Boston, Mass., has been appointed assistant manager of the electric lighting and street railway property in Montpelier, Vt., controlled by the Tenney organization.

**H. D. Crawford** of Parker, S. D., has been appointed superintendent of the Howard (S. D.) electric light plant, which has recently been taken over by the city of Howard.

**George N. Rooker**, general manager of the Sandpoint (Idaho) division of the Northern Idaho & Montana Power Company, has resigned that position, his resignation becoming effective July 1.

**Thomas Crawford**, general manager of the Clinton (Iowa) Gas & Electric Company, has been elected president of the Clinton Commercial Club for 1916.

**J. M. Walsh** has resigned his position with the Gurney Electric Elevator Company of Honesdale, Pa., and is now in the new business department of the Scranton (Pa.) Electric Company.

**B. J. Grigsby**, managing director of The Benjamin Electric Limited, 1a Rosebery Avenue, London, England, sailed from Liverpool on June 24 for a five weeks' business trip in the United States. His personal address while in America will be 24 Mayer Building, Peoria, Ill.

**W. Graydon Stetson**, who has been superintendent of the appliance department of the Boston Edison Company, has resigned, and on Aug. 1 will join the executive staff of F. W. Bird & Son, Walpole, Mass., proprietors of a large industrial plant and owners of two Boston newspaper properties.

**G. H. Liebel** has resigned his position as branch manager of the Robbins & Myers Company, Cincinnati, Ohio, to become president and treasurer of the Liebel Manufacturing Company, recently incorporated to manufacture transformers, X-ray machines and electro-therapeutic equipment.

**A. L. Martin**, manager of the Oregon Power Company at Dallas, Ore., has been appointed manager of the company's system in Marshfield, succeeding R. M. Jennings, recently resigned. Mr. Martin will have charge of the company's plants in Marshfield, North Bend, Coquille and Myrtle Point.

**J. Whyte**, who has been appointed manager of the storage-battery service department of the Prest-O-Lite Company, Inc., Indianapolis, Ind., was formerly electrical engineer for the Maxwell Motor Company of Detroit, Mich. Mr. Whyte was also at one time assistant chief engineer for the Scripps-Booth Company of Detroit, and has been connected with other companies in the automobile and electric-starter business.

**C. Ernest Greenwood**, for ten years a special agent of the Boston Edison Company, connected with its sales department, and for more than three years editor of the company's publication, *Edison Life*, has been advanced to the important position of superintendent of its appliance department, succeeding W. Graydon Stetson. Mr. Greenwood was born in Boston and graduated from the English High School, and from Harvard in the class of 1904. During June of this year he attended the Plattsburg officers' training camp.

DR. J. B. WHITEHEAD

**Dr. J. B. Whitehead**, whose investigations of the electric strength of air and recent invention of the corona voltmeter for measuring high potentials have attracted wide interest among electrical engineers, is professor of electrical engineering at Johns Hopkins University, Baltimore, Md. Dr. Whitehead is a graduate of the same institution, class of 1893, and, following collegiate work, spent three years with the Westinghouse Company, resigning in 1896 to join the staff of the Niagara Falls Power Company as operating engineer. In 1897 he returned to Johns Hopkins as instructor in electrical engineering, and in 1910 was appointed professor of applied electricity. In 1902 he received the degree of Doctor of Philosophy. For a short period Dr. Whitehead also carried on research work for the Bureau of Standards at Washington, D. C., and during the years 1903 to 1906 he was a research fellow of the Carnegie Institution of Washington. The design and installation of the Baltimore & Annapolis Short Line Railroad was carried out under his supervision as consulting engineer. Professor Whitehead has carried on important research on the subjects of inductive emf. in transformers, reactance in armored cables, the operation of single-phase railways and the rectification of alternating current. Recently he has devoted particular attention to studies of the dielectric strength of air and the conditions surrounding the phenomena of high-voltage corona, leading to his invention of the corona voltmeter. Dr. Whitehead was recently appointed an associate member of the United States Naval Consulting Board. He is a Fellow and chairman of the electrophysics committee of the American Institute of Electrical Engineers.

**R. E. Cuthbertson**, for the last four years connected with the Empire District Electric Company of Joplin, Mo., has been appointed secretary of the Elyria (Ohio) Electric Light Company, having been succeeded at Joplin by W. A. Jones.

**C. H. Champion** has been appointed manager of the electrical department of H. Boker & Company, dealers in steel and metals, New York City. Mr. Champion was formerly vice-president and general manager of the Kandem Electric Company, New York.

# NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field*

## Electric Ironing Machine

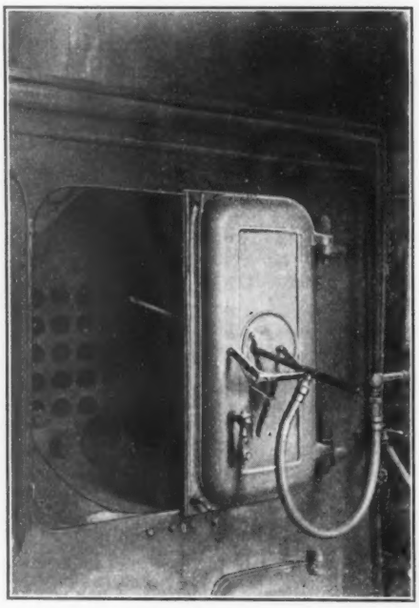
The new and better way for the housewife to do her ironing is to use an electric ironer of the type shown here-

ELECTRICALLY-DRIVEN IRONER WITH GAS-HEATED SHOE

with, according to an announcement of the maker, the Hurley Machine Company, 29 South Clinton Street, Chicago, Ill. With this "Thor" ironer, as it is called, 95 per cent of the ordinary family ironing can be done and the work can be accomplished, it is asserted, at a rate of 8 ft. per minute. At this speed the average-sized batch of ironing can be done in ninety minutes, the manufacturer points out, with an expenditure of 2 cents for electricity and 1 cent for gas per hour. The gloss is provided by an ironing shoe which is heated by gas, the exact temperature being obtained for most efficient ironing. The heated shoe is controlled by a pressure release device. The tension springs which provide pressure allow the shoe to take any thickness of fabric, whether it be handkerchief, sheet or blanket. The machine is particularly well adapted for such work as tablecloths, napkins, curtains, towels, underwear, hosiery, fancy material, pillow cases, soft shirts, aprons, etc. All moving parts of the machine are inclosed, as shown. The frame is of heavy iron and the shelves of galvanized sheet steel which is gray enameled. The switch is on top of the board in front of the gear guard. The ironing machine can also be operated from the motor on a "Thor" washing machine, if desired, so that both machines can be run from one electrical connection. The ironer is being made in three sizes, one for the small family, another for the family of medium size, and the third for the large family or small institution.

## Soot Blower for Fire-Tube Boiler

The Reiter front-end soot blower is a mechanism for blowing out fire-tube boilers and is so constructed that it can be used without interfering with the operation of the boiler. It consists of a steam blower which is inserted through openings in the front flue-cap doors in such a way that the draft is not checked or the steam pressure affected, it is claimed, and no soot blown out into the room. The inner end of the blow pipe is inserted in the tubes, one at a time, and all of the tubes may be blown without interrupting the operation of the boiler or opening the front flue-cap doors. This appeals to the operator for the reason that it makes his work easier and also because the tubes may be



CLEANER INSERTED IN TOP ROW OF TUBES

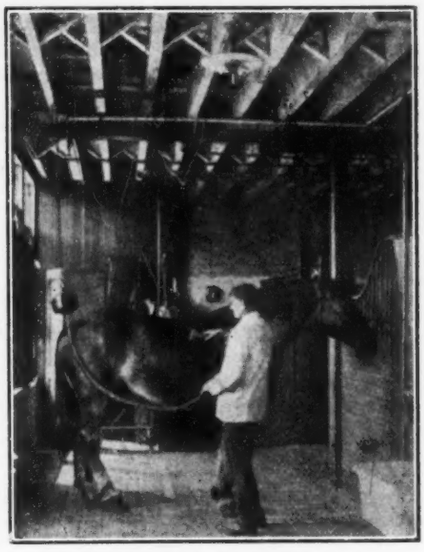
cleaned at any time during the regular working hours without the necessity of selecting a time when the machinery is not in operation.

In blowing out, the steam is forced into the cooler end of the boiler, drawing the heated flue gases in with it, thus superheating the steam and eliminating any condensation or moisture in the tube. This dry steam passes through the tubes at great velocity, stirring up the soot thoroughly, and this opposing force being much stronger than the natural draft, forces every particle of accumulation, it is asserted, through the tube and into the combustion chamber. Here the natural draft forces prevent any settlement and the soot is carried back through the other tubes to the stack.

An adjustable attachment for holding the blower while in operation is provided on the outside of the doors, and half of the tubes are cleaned through the center of each. The vertical support bar has a notch corresponding to each row of tubes, and the cut shows the device set for operating on the top row. In operation the inner end of the blow pipe is passed through the hole in the door and is given the proper angle to be in line with each tube in the top row. The steam is admitted through the valve and the operator can blow each tube by passing the end of the pipe from left to right, or vice versa. By raising the support bar, the second notch engages with the bracket and the pipe is in position for cleaning the second row, and so on until each tube in that half of the boiler is cleaned. The steam is then shut off and the pipe withdrawn and inserted through the other door and the same operation repeated, requiring about four minutes to clean seventy tubes. The device is manufactured by the Reiter Boiler Cleaner Company of Elgin, Ill.

## Portable Electric Clipping Machine

An interesting development, which should be of especial appeal to stablemen and caretakers of horses, is the portable electric clipping, grooming, and buffing machine shown herewith. It can be used anywhere in a stable, or in any place where ordinary lighting sockets are available. When not in use the machine can be hung up out of the way. The portable machine is supe-

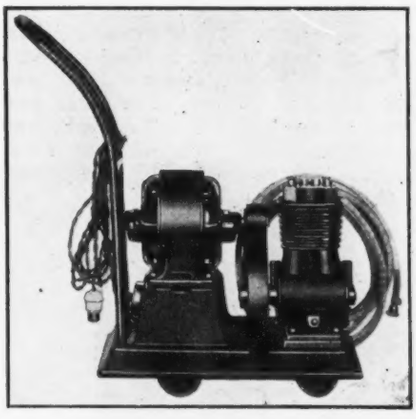


ELECTRIC CLIPPING MACHINE

rior, it is pointed out, to the old type of stationary clipping machine. It is driven by a 0.25-hp. motor, which operates on either alternating current or direct current at a speed of 1750 r.p.m. The machine is equipped with 7.5 ft. of flexible tube chain, flexible reinforced cord, two cutters, one "coarse" and one "extra fine," one handle for cutters, and a grooming attachment consisting of one rotary grooming brush and one extra flexible tube. The weight of the outfit complete is 65 lb. In the illustration, a horse is shown being clipped in the stables of Sheffield Farms, New York City. The electric clipper is being placed on the market by the Gillette Clipping Machine Company, 129 Thirty-first street, New York.

## Electric Tire Pumps

Originally, the only use for compressed air in the garage was for the inflation of tires. Hence, compressors designed for this particular service are now generally known as tire pumps. The field of application for these tire pumps has broadened, however, including such additional uses as operating small pneumatic tools, spraying, blowing dust and dirt from cars, and in vulcanizing work. Although still designated as tire pumps, they are more rightfully compressors, and their use has become so general that they are now practically indispensable in the modern garage. The compressors illustrated are of particular service in private and small public garages. They are being made by B. M. Pero, 509 Pennwood avenue, Wilkinsburg, Pa. Westinghouse alternating-current and direct-current motors are used to operate the compressors, which are made in portable and stationary forms of various sizes. The line includes the following types of machines: Single-cylinder, horizontal, stationary compressor-driven by a 0.25-hp. motor, to meet the requirements of garages housing not



PORTABLE TIRE-INFLATING OUTFIT

more than twenty cars; double-cylinder, portable, vertical compressor, for direct inflation of tires, operated by a 0.25-hp. motor displacing 1.8 cu. ft. of air at 500 r.p.m., with a pressure of 125 lb. per square inch; double-cylinder, portable or stationary, vertical compressor, with a 1/3-hp. motor or a 1.2-hp. motor, for direct inflation of tires, or for use in connection with an air tank; heavy-duty, double-cylinder, vertical compressor, with a 0.75-hp. motor, which is especially suited for operation in connection with an air tank, and the motor of which is of the repulsion type, with starting characteristics that make it particularly desirable, when automatically controlled, for starting against high tank pressures, being designed to start the pump against a tank pressure of 125 lb. and compress to 175 lb. or 200 lb. tank pressure if desired. Undoubtedly the greatest convenience and service is obtained, it is pointed out, when a motor-driven compressor is regulated by an electric pressure controller. It will unfailingly start the motor at the minimum pressure set for, and stop it at the maximum pressure, it is claimed, insuring ample tank pressure day and night without attention other than an occasional oiling. The stationary form of compressors, when designed for use in connection with an air tank, and not for direct inflation, is furnished with suitable electric controllers when desired.

## Portable Electric Reel Lamp

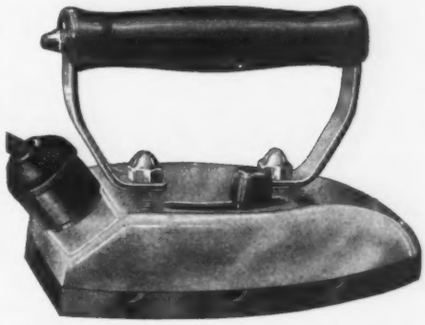
Among the new devices recently placed on the market by the Rubes Electric Devices, Inc., 255 Classon Avenue,

PORTABLE REEL LAMP WITH SPRING CLAMP IN BASE

Brooklyn, N. Y., is the portable electric reel lamp shown herewith. The body of the lamp is adjustable, as is also the shade, which is supported from the push-button socket, thereby permitting the projection of the rays of light, the manufacturer points out, just where desired. Eight feet of cord is provided, which winds automatically within the base when not in use. The base is removable, and permits easy access and clear observation of the winding mechanism. Electrical connection is provided by means of spring contact points of phosphor bronze. The lamp may be attached to the door, bed, dresser, chair, or piano, by means of a rubber-covered spring clamp on the bottom of the base. This clamp folds against the base, and does not obtrude when the lamp is used as a table or desk lamp. Provision is also made in the base for hanging the lamp to a hook, if desired. The base is equipped with four rubber tips, so that highly polished surfaces will not be marred when the lamp is used as a desk lamp. The lamp is being finished in brushed brass, nickel, and copper.

## Electric Iron with Heat Control While in Use

Every housewife is acquainted with the difficulties of getting a flatiron to just the right heat for most efficient



ELECTRIC IRON WITH LEVER FOR REGULATING HEAT

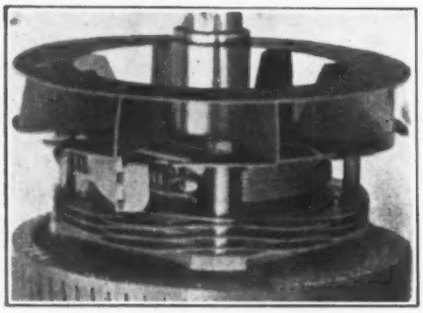
operation. To meet the demand for an iron that will give the exact amount of heat desired, the Reimers Manufacturing Company, 130 Church Street, New York, has brought out the electric iron shown herewith, the temperature of which can be accurately controlled, it is claimed, while in use, and maintained constant at the point wanted. Four different heats (five in the larger irons) are provided, control being accomplished by the finger tips of the operator, by the simple movement of the regulator lever on the iron, heat being obtained suitable for the sheerest of fabrics as well as for heavy, damp materials. By regulating the heat to just that desired, the danger of scorching is obviated. The heating element is so placed that the heat is concentrated at the base of the iron, and, according to the claims of the maker, is practically indestructible. An element was subjected to a test for 3600 hours in the Electrical Testing Laboratories of New York, and was found to have suffered no appreciable deterioration, it is pointed out. Sliding contact is provided, the lever engaging the contact for the next heat before leaving the one in use, thereby eliminating danger of arcing.

## Clutch for Single-Phase Induction Motors

The single-phase induction motor designed with a split-phase winding for starting and not equipped with some other auxiliary device seldom develops more than full load torque, it is declared, at starting. For many applications, notably pumps, the split-phase type of motor is desirable, but it must have a starting torque greater than full

load. In order to accomplish this a clutch, similar to that used on an automobile, is applied to the single-phase motor. The function of the clutch is to allow the rotor of the motor to reach nearly full-load speed before the shaft with its connected load is started. The two members of the clutch are then automatically engaged and the shaft exerts approximately two times full-load torque upon the connected load.

Early clutches were of the drum type in which weights were held close to the shaft by springs. When a certain speed was reached centrifugal force carried the weights out against the drum, and the friction between them and the inner surface of the drum brought the shaft up to speed. In the latest design of motor the drum type of clutch has been abandoned for the multiple-disk clutch. This is very similar to the type of clutch so successfully used upon all modern high-grade automobiles. A multiple-disk clutch of the type shown has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for its split-phase induction motors, and has a number of advantages over the old type of clutch. A high starting torque is developed, the maker points out, the motor picks up to full speed under heavy and increasing loads, and a smooth acceleration of the driven machine is obtained, as well as overload protection for the starting winding. Centrifugal weights are used to operate the clutch as before, but instead of the weights themselves pressing against a drum, the friction between alternate plates of steel and phosphor bronze is used in locking the rotor to the shaft. The clutch is rugged in every detail and is positive in operation, the toggle links multiplying the forces of the weights upon the friction plates. The weights and springs are so adjusted on both the clutch and the switch, used to open the starting winding, that when the motor is operating the switch must open before the clutch starts the shaft. When the motor is retarded by an overload the clutch will slip before the starting winding circuit can be closed. This gives absolute protection against burnout to the starting winding. Slots are cut in the friction disks to prevent warping when one portion becomes heated more than another,



INDUCTION-MOTOR MULTIPLE-DISK CLUTCH

and they also assist in clearing the clutch of oil and dirt. The disks are arranged so that they can be easily replaced should they become scored or burned due to prolonged overload, but in no way can the operating mechanism be harmed. The split-phase motor equipped with this clutch gives the highest starting torque that can be obtained from a split-phase motor, the manufacturer claims, and it will bring up to speed any load it can start.

## Factory Fire-Alarm Systems

Fire-alarm apparatus designed to conform to the requirements of State and city laws in New York and approved by the Industrial Commission, State Department of Labor, New York, and the Fire Prevention Bureau of New York City, has been brought out by the Manhattan Electrical Supply Company, 17 Park Place, New York. Where an absolutely dependable supply of direct current is available such as supplied in New York City, no additional source is required. Where such direct current is not available the system may be operated by primary batteries. Either single-stroke electric bells or electro-mechanical gongs may be used. Boxes are of the code ringing type, sounding a number on all gongs in the system, indicating the location of the alarm. All systems are electrically supervised throughout, a weak current passing

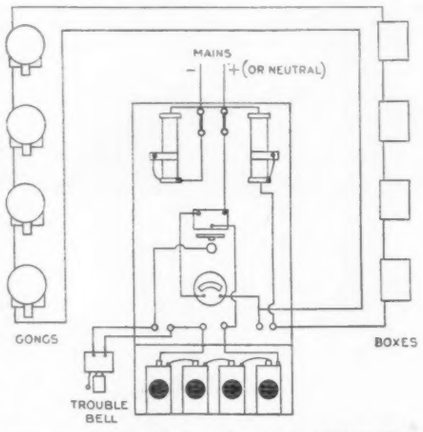



FIG. 1—ELECTRO-MECHANICAL GONG SYSTEM FOR 110-VOLT TO 125-VOLT DIRECT-CURRENT CIRCUITS

constantly over all parts of the box and gong circuits. Any interruption of the circuits or failure of the current for any reason will cause the trouble bell to ring continuously. Boxes, gongs and cabinets are regularly fitted for 0.5-in. pipe connections, but can be designed for 0.75-in. pipe, and both gongs and boxes can be fitted with outlet boxes for concealed wiring if desired.

In Fig. 1 is shown a diagram of connections for an electro-mechanical gong system operated by direct current at from 110 volts to 125 volts. The control board is inclosed in a steel cabinet and is provided with trouble bell and battery, relay, ammeter and adjustable resistance coils. Gongs and boxes are connected in one circuit, as shown in the diagram, in any number up to fourteen gongs. If more than fourteen gongs are required they are placed in separate circuits of not over fourteen each.

In Fig. 2 is shown an electro-mechanical gong with wiring box separate. This device has just been developed. The mechanism is inclosed in a dust-proof and weatherproof red-enameled case. The gong is mounted on top of the case and extends beyond it so that there is no interference with the free movement of sound waves. The revolving hammer strikes the inside edge

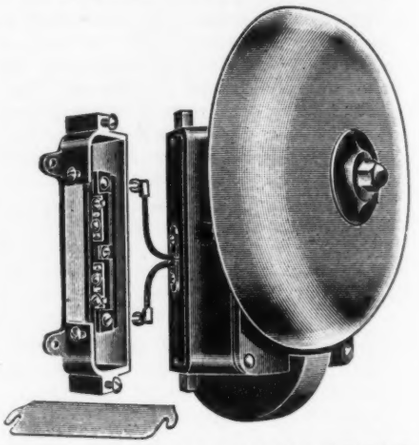


FIG. 2—BELL WITH WIRING BOX SEPARATE

of the gong. It is thrown outward to the striking position by centrifugal force. The locking lever of the tripping mechanism approaches the locking position without displacing the armature or interfering in any way with any portion of the mechanism so there is no possibility of sticking. Very little energy is required as the pressure on the tripping points is light. A bell wound for 20 ohms will trip on 50 milli-amp. The bell will give 400 strokes to each winding and operates on either open or closed circuits. It can also be arranged as a constant ringing gong.

## Electrically Heated Glue Kettle

The "Electro-Steam" glue kettle shown herewith has been brought out by the Hulbert Electro-Steam Manufacturing Company, Fairfax Avenue and Rankin Street, San Francisco, Cal., and is being made in two standard sizes, one with a capacity of 1 gal., and the other of 3 pints. The outer portion of the kettle is of wrought and cast iron, heavily galvanized after being riveted together. The inner vessel

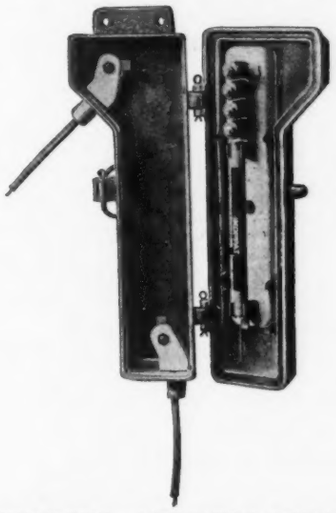
ELECTRIC GLUE POT

is of aluminum, while all fittings are of brass. The inner and outer kettles are flanged and securely bolted together, and thus form a steam-tight chamber or jacket, inside which is placed the

electric heating unit, with wires leading through conduit to the controlling device screwed into the upper portion of the jacket. A cord with attachment plug is provided to connect the apparatus to any ordinary lighting socket. Use is also made of a combination filling and safety device for replenishing the water in the jacket and rendering the entire apparatus foolproof, it is claimed, by relieving excessive pressure should the controlling device be misadjusted. The kettle is equipped with a water glass, which shows the exact level of the water in the jacket. The action of the kettle, the manufacturer points out, is entirely automatic. When the current is turned on, the water in the jacket is quickly heated, thus warming the glue. By the time the glue is heated a slight steam pressure will have been produced, which causes the controlling device to operate, separating the platinum contact points and breaking the electric circuit. As long as this pressure is maintained the glue is at the proper heat, and no electricity is being used. But with the slightest falling of temperature, and the consequent reduction of pressure, the contacts come together for a few seconds, and the pressure is regained. Thus the circuit is broken and re-established as the condition of the glue requires, which reduces the consumption of electricity to a minimum.

## Single-Pole Lightning Arrester

For use on alternating-current circuits of any frequency, and pressures of from 1000 volts to 2500 volts, and of unlimited capacity, the Westinghouse Electric & Manufacturing Company,

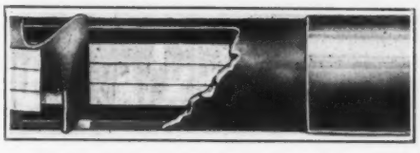


SINGLE-POLE, ALTERNATING-CURRENT LIGHTNING ARRESTER

East Pittsburgh, Pa., has recently placed on the market the Type CR lightning arrester illustrated herewith. This type of arrester is designed for pole mounting, and is similar in many respects to the company's Type C arrester, with the addition of series resistance. It consists of four knurled, non-arcing, metal cylinders mounted on a porcelain base, with a series resister, which is held by fuse clips, the whole being mounted in a cast-iron box. The arrester unit is mounted on the inside front cover of the box, so that it is automatically disconnected from the circuit when the box is opened. This safety-first feature eliminates all danger of accidental shock to linemen when making inspections and repairs. This method of mounting the arrester unit is especially desirable in an arrester of this kind, which will ordinarily be used in considerable numbers on a line and receive routine inspection. Like the Type C unit, the Type CR arrester is designed particularly for the protection of distributing transformers, and is unlimited in application, the maker points out.

## Refillable Cartridge Fuse Shells

In the accompanying illustration is shown a section of a refillable cartridge fuse shell, recently developed by A. F. Daum, Pittsburgh, Pa. This fuse shell consists essentially of a fiber body provided at each end with a brass cap which not only forms a means of electrical contact between the clips of the fuse block and the fuse, but also serves to retain the fuse wire or strip. Each end of the fiber body is drilled with two small holes into which are inserted



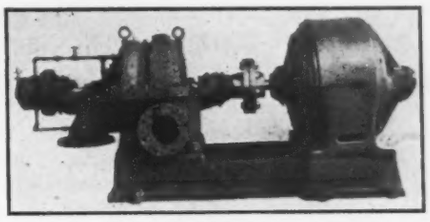
SECTIONAL VIEW OF REFILLABLE FUSE

brass pieces of the form shown. The inner ends of these pieces project through the holes and, being somewhat wider at that end than the external diameter of the body, allow the threads inside of the cap to ride upon them and thereby secure the cap. To insert a fuse strip both caps are removed, the strip passed through the shell and the ends bent over the brass end pieces. The caps are then screwed in place and grip the bent-over portion of the fuse strip between the end piece and the inside of the top of the cap. The fuse is designated by the manufacturer as a Type B, Form 4 device.

## Electric High-Speed Pumps

A line of high-efficiency electric pumps has recently been developed by the Morris Machine Works, Baldwinsville, N. Y. The pumps are being built in various sizes, depending upon the conditions under which they are to operate. The machines are horizontally split, the suction and discharge openings being in the bottom half; consequently, in order to dismantle the pump and get at the interior, or to remove the impeller and shaft, it is not necessary to disturb either the suction or delivery-pipe connections or bearings.

The bearings, which are attached to the bottom half of the pump, are of the automatic ring-oiling type, with removable babbitted sleeves. From the illustration it will be noted that they are of the outboard type, so that the water pumped does not come in contact with them. Single-stage pumps are being built with double-suction openings which permit a perfect balancing of the pumps for end thrust, which is entirely eliminated. The thrust in the multi-stage pumps is taken care of by a



MOTOR-DRIVEN PUMPING OUTFIT

water-cooled marine-type thrust bearing running in oil.

The impeller is of bronze, and is mounted on a steel shaft protected by a removable bronze sleeve where it passes through the stuffing boxes, and also where it comes in contact with the water pumped. On each side of the impeller is a circular labyrinth ring, which projects into a machined opening on each side of the pump case for the purpose of adjusting clearances. It also prevents leakage in the single-stage pumps from the casing back into the suction; and in the multi-stage pumps between the various stages. The coupling is of the flexible type, to compensate for any slight movement endwise caused by the motor armature or any misalignment of the motor or pump shaft. All parts of the pumps are built from templet, and are therefore interchangeable, so that where repairs are required they can be readily assembled in the field. Where the water to be pumped contains acid, such as in coal mines, dyehouses, paper and textile mills, the entire pump end is made of anti-acid bronze. The multi-stage pump is well adapted for municipal water works. Some time ago the city of Charlotte, N. C., was furnished with a Morris 12-in., two-stage pump, directly connected to a 350-hp. motor of this same type. This pump, under test, developed 76.5 per cent efficiency when delivering 3500 gal. per minute against a 260-ft. head requiring 300 hp.

For some years past, centrifugal pumps have been successfully used for boiler feeding. For this work the Morris Machine Works has designed a multi-stage, horizontally split pump of the same type as the one illustrated, with the exception that the impellers are opposed. The intake is in the center of the pump, so that the stuffing boxes are always under pressure. From experience it has been found that a boiler installation of more than 1000 hp. can be satisfactorily fed with a centrifugal pump. All of the horizontally split, high-efficiency pumps are designed for high speeds, and therefore are especially adapted for direct connection to high-speed motors or steam turbines.

# NEWS OF THE INDUSTRY

*A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields*

## NEW MINIMUM BILL FOR CHICAGO

### Public Service Commission and City Express Their Attitude Concerning It

At the same time the Commonwealth Edison Company of Chicago voluntarily offered to reduce electric service rates to the extent of $1,000,000, as reported in the ELECTRICAL WORLD of May 20, it applied to the State Public Utilities Commission of Illinois for permission to establish a 50-cent minimum bill for residence customers. The attitude of the commission and of the City Council toward this action as set forth in the finding of the commission and by a letter from E. W. Bemis, consulting engineer, to the City Council's committee on oil, gas and electricity, is interesting as indicating the trend of regulatory opinion.

The provision which the company desired to institute covering the minimum charge where there had been no minimum charge for service used for lighting purposes called for a minimum charge of 50 cents per month per meter, except that where a portion of the connected installation is power apparatus (other than any household utensil having a rated capacity of 660 watts or less), the minimum charge shall be 50 cents per month for each horsepower or fraction thereof for such power apparatus.

#### STATEMENT OF COMMISSION

In rendering its decision the commission said: "It is the apparent intent of the public utilities law of this State to forbid a utility company from rendering service at a discriminatory rate, whether such a discriminatory rate be either unduly high or unduly low. If a utility in order to render service to a consumer is compelled to install equipment for that consumer's service, and to pay the attendant fixed charges and maintenance expense thereon, and in addition is compelled to make periodical visits to the consumer's premises for the purpose of reading his meter, to carry his account upon the books, and to compute and deliver his bills each month, a certain expense is entailed by the company solely by virtue of the fact that the consumer is connected to the circuits. If the company makes a certain reimbursement for these expenses, it is necessary that a certain minimum be fixed below which the customer's bills shall not be allowed to fall.

"The objection most frequently made to the minimum bill is that a customer should not be compelled to pay for service which he does not receive. We are inclined to the belief that a customer connected to the utility circuits receives some service solely by virtue of such connection in that he has the opportunity for using the service and realizing its benefits, and that this service so received is very separate and distinct in nature from the service which he receives by actual use of the current.

#### HOW THE 50-CENT MINIMUM WAS JUSTIFIED

"As to the equity of the amount of the minimum charge proposed, considerable evidence was introduced by the petitioner. An equitable minimum bill should include all expense incurred solely on account of the customer's installation, and in addition must include the cost of the energy actually used by the customer. If the minimum included only the first-mentioned expense it is apparent that the small amount of current actually used would be furnished free of charge. There is herewith reproduced a tabular statement of expenses to which the company is put for each consumer, regardless of the amount of service which he may require, including the cost of the added amount of energy used by consumers whose bills are less than the 50-cent minimum here required."

#### COST TO COMPANY 65.8 CENTS PER BILL

This statement was presented in evidence by the company, and at the same time it was emphasized that these data show that the actual cost to the company of supplying or standing ready to supply service to customers whose bills are less than 50 cents per month, is 65.8 cents per customer per month, excluding fixed charges on the company's investment in such items as power houses, transmission lines, substations and transformers, and also excluding any part of the cost of operating and maintaining such investments and also excluding other items that might be included, such, for instance, as transformer losses. A particular effort was made to establish the fact that while 65.8 cents is by no means the entire amount which should be included in a complete allocation of the cost of readiness to serve a customer it is a sufficient amount to justify the 50-cent minimum.

SUMMARY OF THE CUSTOMER'S COST INCLUDING ALL ITEMS ON CUSTOMER'S PREMISES

| | *Cost per Customer* Annual | Monthly |
|---|---|---|
| Fixed charges on first cost of watt-hour meter | $1.03 | $0.086 |
| Meter reading, billing, bill delivery, bookkeeping, claim and statistical | 2.01 | .167 |
| Meter installation, removal, maintenance and testing | .90 | .075 |
| Fixed charges on cost of first supply of incandescent lamps | .23 | .019 |
| Inspection on customer's premises | .20 | .017 |
| Customer's repairs, including household devices but excluding meters | .34 | .028 |
| Fixed charges on service connection | .41 | .034 |
| Maintenance of service connection | .15 | .013 |
| | $5.27 | $0.439 |
| General expense, such as office rentals, telephone, telegraph and general supervision at 15 per cent of the particular expenditures listed above | .79 | .066 |
| Total customer's cost | $6.06 | $0.505 |
| Energy used by average customer whose bill is less than 50 cents | 1.84 | .153 |
| | $7.90 | $0.658 |

The commission ordered the schedules to go into effect on July 1, 1916.

#### THE ATTITUDE OF THE CITY

E. W. Bemis, in a letter to the City Council's committee on oil, gas and electricity, said that the advantages to be gained from accepting the company's proposal were so many, and that the application of the 50-cent minimum affected so few, that he did not think the city should object to the company's proposal. He recommended, however, that the city take care not to commit itself to the position of recognizing the authority of the State Public Utilities Commission to set aside contracts between the city and the utilities, as such action might have a far-reaching effect in connection with other utility companies in the city.

## LEXINGTON FRANCHISE SETTLED

### Agreement Reached Between the City and the Lexington Utilities Company Through Conferences

By unanimous vote the Board of City Commissioners of the city of Lexington, Ky., at its meeting on July 10 passed the electric light franchise ordinance framed by the Utilities Bureau, and agreed to some days prior at a final conference of the city fathers and representatives of the Lexington Utilities Company, which will probably be the only bidder on the franchise.

The passage of the ordinance concludes the negotiations on the electric light franchise proposition which were virtually begun more than three months ago when the City Commissioners on March 31 approved an ordinance providing for the employment of the Utilities Bureau to look after the interests of the city and prepare a franchise that would be fair alike to the city and to the utilities company. Dr. Milo R. Maltbie of New York, and Clyde L. King of Philadelphia acted for the city as representatives of the Utilities Bureau, and James M. Boyle of Sanderson & Porter, New York, acted for the Lexington Utilities Company.

The ordinance directs the Mayor of the city to sell a franchise authorizing the purchaser to construct, maintain and operate an electric light and power plant, and to generate, transmit, distribute and sell electrical energy to the city of Lexington and the citizens thereof. The new franchise is for a term of twenty years. The maximum rate for lighting will be 9 cents. This, with a 10 per cent discount, will make the rate 8.1 cent, or a reduction of 40 per cent from the present rate. The commercial lighting and incidental power maximum is 8½ cents, or 7.65 cents with the discount. The power rate is 8 cents, or 7.2 cents with the discount. These are the maximum rates and the basis of such graduated scale as the company may work out to meet the needs of large consumers. The minimum charge to residences is $1 per month.

The commissioners are empowered to prescribe methods of keeping accounts and are given absolute rate-making power at four-year periods, but the rates are not to be made higher than the maximum in the franchise. The lowest upset price set by the city for the franchise is $10,000, and the rates are to take effect Nov. 1.

Like the case of the city of Philadelphia against the Philadelphia Electric Company, in which both Dr. Maltbie and Mr. Boyle also acted, the final decision was reached after a series of conferences, thereby eliminating expensive hearings and litigation. By the terms of the franchise the successful bidder must pay one-half of the $10,000 in cash and the other half on or before Dec. 31, 1916. Revision of the rates will come up at four-year periods coincident with presidential election years, at which time there are no local elections in Lexington, and provision is made that if the board shall revise the rates, notice shall be given on or before March 1 of that year. The company is protected by the inalienable right to appeal to the court for release if it believes the rates adopted are unreasonable and unjust.

The Municipal League, which was organized to persuade the commissioners to employ experts to aid the city in reaching a proper basis of rates, expressed complete satisfaction with the new lighting franchise. Citizens generally who have examined the provisions are also said to be much gratified at the low rates and favorable conditions guaranteed in the document. In a letter to Mayor Rogers last week, Milo R. Maltbie wrote:

"I want to thank you for the many courtesies I received from you and other city officials when in Lexington. I enjoyed my visit immensely and have seldom worked upon a case where there was such good feeling and determination, not only to serve the interests of the city, but to deal fairly and justly with the company.

"The city of Lexington is to be congratulated upon the results achieved and the manner in which the entire franchise settlement has been conducted by you and your associates. There are scores of cities much larger than Lexington that would shout with joy if they could secure as low rates and as favorable a franchise as you have secured for Lexington."

Both Dr. Maltbie and Mr. Boyle also recommended the abolishment of all the arc lamps in the city and the substitution therefor of gas-filled tungsten lamps. The chances for a "White Way" in Lexington are also very bright.

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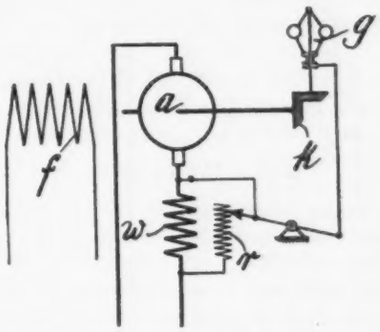
## Speed Regulation of Commutating Fields

A novel commutation theory is propounded by Ludwig Binder, which he has made the basis for a patent (No. 1,188,396) assigned to the Siemens-Schuckert Werke of Berlin, Germany. He states in substance that whereas it is known in alternating-current commutator machines the commutating fields must be varied with the speed, such commutating field, held requisite for destroying the reactance voltage in direct-current machines, has heretofore been regarded as independent of the speed. This assumption is held by him to be incorrect, for he states that not only has it been found that the commutating field must be made dependent on the current, as




SPEED REGULATION OF COMMUTATING FIELDS

usual, but that, in fact, in direct-current machines in order to correct properly for the reactance voltage, the commutating field should be made dependent on the speed exactly as in alternating-current machines when correcting for the so-called transformer voltage. A number of variations are described in the specification and claims which are substantial equivalents to the accompanying illustration. It will be seen that as the speed increases the ampere turns in the commutating pole winding are diminished by means of a centrifugal control of a variable resistance.

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## Electric Drive for New U. S. Battleship Tennessee

Announcement has just been made that the contract for the electrical propulsion machinery of the new United States super-dreadnaught Tennessee has been awarded by the Navy Department to the Westinghouse Electric & Manufacturing Company. The equipment will include 33,000 hp. in turbine-alternators for operating the four main propeller motors, each rated at 6500 hp., besides the turbine auxiliary apparatus and the ship's lighting and power generating plant.

# Public Service Commission News

## Connecticut Commission

The Union Electric Light & Power Company was not required by the Public Utilities Commission to build a 1-mile extension at a cost of $1,500 or $2,000 to serve one residence only, or, failing to do so, allow an outside utility, the Hartford Electric Light & Power Company, to render the service, since the great disproportion of the probable income to the cost of the extension relieves the former from its service duty without impairing its exclusive right to serve the territory.

## Colorado Commission

The Public Utilities Commission has power over any court or any city to fix the rates of public service corporation, according to the decision of the Supreme Court in the Englewood case involving charges on the Denver & South Platte line, which connects with the railway at Englewood. By this decision the commission, it is believed, may disregard any city franchise or any court decision in dealing with public service corporations. The court said "the power to regulate the rates of the public utility in question is vested by the act [public utilities act] exclusively in the public utilities commission."

The case concerned a repudiated contract. The Englewood Council three years ago passed an ordinance compelling the Denver & South Platte line to issue and accept transfers from the Denver Railway line connecting with it. The road obeyed the ordinance for a while and then repudiated its agreement. The city of Englewood carried the case to the District Court, where Judge Class delivered an opinion upholding the ordinance. On appeal the commission intervened, arguing that it alone had the right to regulate rates. This contention is upheld by the court, and the judgment of the District Court reversed. The commission may later hear the dispute between the company and Englewood.

## Maine Commission

In considering the application of the Oxford Electric Company for approval of the purchase of property of Mechanic Falls Electric Light Company and for issuance of securities, the Public Utilities Commission held that it was its duty to do more than act merely upon information presented by the parties in interest. The point came up when the commission considered a letter protesting against "any further issue of stock or bonds than what is actually necessary for the purchase of a new plant."

An objection to the issuance of securities beyond the amount necessary for the purchase of a plant to be taken over upon consolidation based upon the theory that any increase in capitalization will have to be met by the ratepayers, is not valid, the commission held, where there will be no material increase in the capitalization of the combined companies, and where, under the utilities act, the rates are controlled by the fair value of the property, and not by the capitalization.

The plan for the purchase of the property and for the assumption of the liabilities of the Mechanic Falls Electric Light Company by the Oxford Electric Company for $30,000 in 6 per cent non-cumulative preferred stock of the latter company was approved upon condition that the stockholders of the former company pay a cash dividend of 12 per cent on its outstanding capital stock.

The Oxford Electric Company was authorized to issue 300 shares of non-cumulative 6 per cent preferred stock, dividends payable semi-annually in payment of the property of the Mechanic Falls Electric Light Company, and was further authorized to mortgage its property to secure an issue of $250,000 par value 5 per cent bonds, and to sell such bonds of the value of $175,000 at not less than 90, for the purpose of discharging certain bonded and other indebtedness of the two companies.

## Massachusetts Commission

The first instance in which the authority of the Board of Gas and Electric Light Commissioners was invoked under an act permitting a municipal plant to supply other towns was in the recent application of the town of Middleboro for permission to furnish energy to the town of Lakeville and inhabitants. By this act the Legislature clearly indicated that such extensions may be made, and left to the board merely the expediency of each particular undertaking in view of its own peculiar circumstances. The board was therefore of the opinion that the question seemed to be confined to whether or not this extension of the Middleboro plant is likely to jeopardize the interests of the taxpayers of Middleboro, or of its inhabitants, who have the primary right to a supply from this plant, or of both. In some circumstances, it was pointed out, this might prove a difficult and even embarrassing problem. The board, however, did not feel that it would be justified in withholding its authorization of the undertaking.

## Montana Commission

Upon complaint of the citizens of Roundup and Klein, charging excessive rates by the Roundup Coal Mining Company, which sells its surplus energy to the two abovementioned cities, the Public Service Commission has issued an order fixing new rates. In its decision the commission held that the utility was not enttiled to amortize the value of its franchise, since it had been given by the public without receiving valuable consideration therefor.

No allowance was made for going value, as there was no evidence that the plant was operated at a loss during the early years of its existence, and the reports of the company showed that the business in recent years has been very profitable, and it is therefore reasonable to assume that such losses as may have been sustained during the early period of operation have since been written off by the profitable operations of the later years.

Only the actual and necessary expense incurred in securing a franchise can be allowed in a rate valuation. In valuing the land occupied by the steam electric genenerating plant, the commission allowed five times its normal value because of its proximity to the source of fuel supply. The amount of steam used for generating electric current was fixed according to the proportion which the steam used for that purpose bore to the total amount of steam generated. The expense of a steam plant used in several departments was apportioned according to the amount of steam used by each, as was also the value of electric generating equipment.

Eight per cent of the value of the physical properties was allowed for engineering in the rate valuation, 5 per cent for interest during construction, 1 per cent for insurance during construction and 1 per cent for incidental expenses, consisting of office expenses and supplies during the construction period.

Demanding a deposit from the consumer as a guaranty against injury to the meter was held to be in violation of the rulings of the commission in cases where no interest is paid on the deposit and the meter value is included in the value of the plant. The company was authorized to require as security for payment a deposit equal to 1.5 times the amount of the average billing period bill. The utility was ordered to pay interest at the rate of 6 per cent on these deposits, provided they are left with the company six months or more, and providing the consumer has taken service continuously during that period.

**"Development"—A New Publication.**—Day & Zimmermann, constructing and operating engineers, Philadelphia, Pa., have just issued the first number of *Development*, a "journal to dispense ideas, advice and information for use in the proper development of industries and public utilities."

**Wheat Threshed by Electricity.**—For the fourth time in Kansas, so far as is known, wheat is being threshed by electric power. Nine wheat growers have organized a co-operative company and have purchased an outfit and a transmission line. They say the cost is 50 per cent less than threshing by steam.

**Company Releases Claim to Power Site.**—The McKenzie River Power Company, under which name the Oregon Power Company filed on a power site on the McKenzie River, Oregon, a number of years ago, recently filed with the county clerk a release to R. J. Graf of Chicago of all its right, title, interest or claim or demand that it may have in and through a certain contract between James A. Resides and the power company, dated Nov. 27, 1909, in 111.66 acres of land in section 36, township 16 south of range 2 east.

**Public Utility Valuation Bibliography.**—There has been prepared by the library staff of the American Society of Civil Engineers, under the direction of the committee on valuation of the American Electric Railway Association and published by that association, a bibliography on valuation of public utilities. It is exceedingly comprehensive, comprising some seventy-two pages. Copies may be obtained from the American Electric Railway Association, 8 West Fortieth Street, New York City.

**Light Company Makes Change to Better Electric Service.**—The interruptions to the power received from the Niagara transmission lines during the electrical disturbances each summer has caused the people of the west side of Rochester inconvenience, it is reported. To safeguard this section in its lighting and power system the Rochester Railway & Light Company has disconnected the Niagara power from the 11,000-volt feeder to the west side and is supplying power to the line from a steam station and a hydraulic station. The feeder runs from Genesee Valley Park along the west line of the city to Charlotte.

**Water Power Legislation.** — Agreement reached on Tuesday between the House leaders and Representative Kent of California, representing the conservationists, indicates that the House will try to pass a very different measure to control the development of power on navigable streams than the Shields bill. The Kent amendment, which was accepted by Chairman Adamson of the Interstate and Foreign Commerce Committee, provides that at any time after the expiration of the grant, by giving six months' notice, the United States can take over the dam and locks erected by the original grantee. Payment to be made by the Government is to include actual cost of dam, locks and other "aids to navigation," plus the "reasonable value" of all other property taken over.

## *Current News and Notes*

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

**Yosemite Park to Have Hydroelectric Lighting Plant.**—In the sundry civil bill which recently passed the House of Representatives for the protection and improvement of national parks in California there was an item of $150,000 to be expended for the construction of a hydroelectric plant for the use and benefit of the Yosemite National Park.

**Birmingham Company Inoculates Employees.** — The Birmingham Railway, Light & Power Company about one month ago made arrangements whereby each employee not only had the privilege of becoming inoculated against typhoid fever, but a strenuous effort was made to get every employee to take the same. The company is offering this inoculation free to its employees and at cost to their families.

**New Half-Million-Dollar Plant for Binghamton.**—The Binghamton (N. Y.) Light, Heat & Power Company, it has been announced, is about to erect a $500,000 plant along the Lackawanna Railroad. A tract of land embracing 43 acres has been obtained. The new plant upon completion will serve as the main generating station of the company, and the present plant will be used as an auxiliary.

**Chimneyless House Nears Completion.**—A house without a chimney is nearing completion in Hood River, Ore. It is being built for E. Fewell, engineer of the Hood River Gas & Electric Company's plant. The entire equipment within and without the house, even to the milking machine in the barn, is to be operated by electricity. The structure, it is said, will be one of the most handsome houses in Hood River county.

**Power Company Forms Steam Heating Company.** — The Spokane Service Company, a new corporation organized by the Washington Water Power Company for conducting a steam heating business, has elected the following officers: President, D. L. Huntington; vice-president, C. S. MacCalla; secretary, A. F. S. Steele; treasurer, Y. M. White; manager, N. A. Kemmish. D. L. Huntington, C. S. MacCalla and Harry L. Bleecker are the trustees. The company will start out on the plan of taking over and operating steam-heating plants now serving Spokane buildings. Although plans have not been worked out in final detail, it is reported that fuel and electricity will be combined in generating steam.

**U. S. Civil Service Examination for Laboratory Assistant.** — The United States Civil Service Commission announces an open competitive examination for laboratory assistant on Aug. 23 and 24. From the register of eligibles resulting from this examination certification will be made to fill existing vacancies and vacancies as they may occur in this position in the Bureau of Standards, Department of Commerce, at entrance salaries ranging from $900 to $1,200 a year, and vacancies as they may occur in positions requiring similar qualifications. This examination is also scheduled in the Fall Manual to be held on Oct. 11 and 12.

**Preliminary Report on the Characteristics Leading to Success in Engineering.**—Last March the joint committee on engineering education sent to the members of the national engineering societies a card asking them to list in the order of importance a number of characteristics leading to success in engineering. Character was rated highest, judgment next, efficiency third, understanding fourth, knowledge fifth and technique of practice and business last.

**Electrical Men to the Front.**—In addition to list printed in the ELECTRICAL WORLD last week it has been brought to our attention that employees of the following companies have enlisted for service under the American flag on the Mexican border: Mobile (Ala.) Electric Company; Manchester (N. H.) Light & Traction Company; Virginia Railway and Power Company, Richmond, Va.; Consolidated Gas, Electric Light & Power Company of Baltimore, Md.; Beacon Light Company, Chester, Pa. In addition to the men who enlisted from the Schenectady plant of the General Electric Company, as announced last week, it is learned that forty men enlisted from the Lynn plant and approximately the same number from the Pittsfield plant of the company. A total of 275 employees also enlisted from the various offices of the Western Electric Company and from the company's plant at Hawthorne.

**Connecticut Electric Light Statistics.**—The annual report of the Connecticut Public Utilities Commission for 1915 contains the following statistics on electric companies engaged solely in the sale of electrical energy for heat, light and power of which at the present time there are twenty-five companies, four being nonoperating. On June 30, 1915, the combined assets were $19,-,49,152.41, of which the major portion ($15,806,185.81) was for plant and equipment. The capital stock as of that date was $11,053,115, bond issues, $3,097,500, and bills and notes payable, $2,266,884.42. The combined surplus was $2,118,013.36. For the year ended June 30, 1915, the revenue from the sale of energy for all purposes was $3,522,397.86, or an increase of $220,-935.62. Expenses, which amounted to $2,458,944.78, were divided as follows: Production, $931,415.12; transmission, $72,054.20; distribution, $312,549.23; electric energy purchased, $159,363.80; taxes, $173,438.44; depreciation, $417,-380.22; miscellaneous general expense, $392,743.70. All expenses showed an increase totaling $307,326.45 over the previous year. The largest increase was $121,439.40 for depreciation, and the smallest $484.23 for transmission expense. Taxes during the year were increased by $82,243.03.

**Electrical Week Poster Exhibit at Atlantic City.**—The poster exhibit from which will be chosen a suitable poster for America's Electrical Week was on view this week at the convention of the American Bill Posters' Association in Atlantic City.

**New Business in Los Angeles Territory.**—S. M. Kennedy, general agent of the Southern California Edison Company, in his report to the directors for 1915, concludes with the following remarks regarding the prospects for 1916: "The improvement in general business conditions is expected to bring with it a greater demand for electric energy for some of the newer uses. The motion-picture producing companies are calling for increasing amounts of power as this business develops; electric smelting and electric enameling concerns are asking for considerable blocks of power at high load factors; ice making and refrigeration by electric power is more in evidence, and contracts have been negotiated covering service to several hundred horsepower to be used in the reduction and treatment of sewage, the utilization of kelp and the operation of machinery for drilling and pumping oil wells. An extensive campaign has already been inaugurated to develop and promote the use of the electric range for domestic cooking, and it is expected 1916 will see a large additional load from this source."

**Coal Mined in 1915.**—The production of bituminous coal and anthracite in the United States in 1915 amounted to 531,619,487 short tons, valued at $686,-691,186, an increase, compared with 1914, of 18,094,010 tons, or 3.5 per cent, in quantity, and of $5,200,543, or 0.8 per cent, in value, according to C. E. Lesher of the United States Geological Survey. Of this total output, 442 624,-426 short tons, valued at $502,037,688, was bituminous coal and lignite, and 88,995,061 tons, valued at $184,653,498, was Pennsylvania anthracite.

**Flood-Lighting of San Francisco Civic Center.**—By way of experimenting with flood-lighting effects on the new San Francisco civic center, the illumination and fireworks program for July 4 included the use of eight 18-in. projectors. These were provided with diffusing lenses to give an oblong-shaped beam. Two were mounted on the Exposition Auditorium roof and six on the new library building, all being directed toward the city hall. Behind each of the large columns which were used for architectural effect on the city hall façades, there was mounted a 100-watt incandescent lamp, stained red, in a metal reflector, arranged so as to cast the rays upward. The lamp was concealed and the effect produced was a subdued red glow superimposed on the white granite surface illuminated by the searchlights.

**New $3,000,000 Kentucky Hydroelectric Plant.**—Construction of the $3,000,-000 hydroelectric plant on the Dix River near Kennedy's Mill, Lancaster, Ky., projected for several years, has been begun under Louis B. Herrington of Richmond, Ky. It is said that the plant will supply power for a number of Kentucky cities.

**Public Utility Accounting Course for Princeton.**—The new accounting course which will be given at Princeton University next year will serve to supplement and greatly strengthen the work that has been done in money and banking, finance, and general economics. It will deal with the functions and principles of accounting as applied to modern industrial organization and to the relation of government to the railroads, public service corporations, trusts and other business. Special emphasis will be placed upon the fundamental concepts of capital, capitalization, investment, reserves, surplus, expenses and income. These ideas will receive definite application in the study of balance sheets, income statements and other financial reports of corporations. The Pliny Fisk Finance Library, which was given the past year to Princeton University, has a great wealth of accounting material, which will be invaluable in giving concrete expression to the principles that will be emphasized in the course.

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## *Associations and Societies*

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

**Electrical Supply Jobbers.**—A meeting of the Electrical Supply Jobbers' Association will be held at the Hotel Statler, Cleveland, Ohio, on Oct. 10, 11 and 12.

**Cleveland Electrical League.**—Herman Fellinger, president of the German-American Alliance of Cleveland, spoke before the members of the Cleveland Electrical League at Hotel Statler on July 7.

**Oregon Electrical Contractors & Dealers.**—At the quarterly meeting of the Oregon Association of Electrical Contractors & Dealers held in Portland on June 28, a proposal was made to have enacted a State license law, which would require all workers in electrical equipment to be examined by a State Board and secure a license. J. W. Oberender, secretary of the association, reported on the advisability of changing the State lien law, as it applies to supplying materials for building purposes, in accordance with the changes which have been proposed by the Material Dealers Credit Men's Association. It was decided to extend the plan of the organization so as to take in the entire Pacific Coast territory, and, accordingly, President W. O. Fouch has appointed a committee to work up the plan. The officers of the association are: President, W. O. Fouch; vice-presidents, F. C. Green, J. R. Tomlinson, J. H. Stroufe, Samuel Jagger, Edward Pierce, all of Portland; D. W. Paul of Medford, and John L. Vaughan of Pendelton; secretary-treasurer, J. W. Oberender of Portland.

**Milwaukee Section, N. E. L. A.**—J. D. Mortimer, president of the Milwaukee Light, Heat & Traction Company, and N. C. Christopherson spoke at the fourth annual "Jollification" of the Milwaukee section, National Electric Light Association, at the Hotel Pfister, on June 29.

**Georgia Electrical Contractors.**—The semi-annual meeting of the Georgia Electrical Contractors' Association was held at Hotel Tybee, Tybee Island, on July 3 and 4. The first day's session closed with a banquet, tendered by Savannah electrical contractors to those attending the convention. Short talks were made by George Scheone, P. C. Gilham and J. C. Cabiness of Atlanta, and Frank M. Byrne and T. P. Sandiford of Savannah, and a number of others. An open session of the convention was held on Monday morning at which jobbers, contractors and salesmen were present. The session was purely informal and short talks were made by a number who were called on by the chairman. The afternoon session was a closed one, for contractors only, and a number of routine matters were disposed of.

**Dallas Electric Club.**—The Dallas Electric Club held its annual picnic at Kirkland Park on June 24. The afternoon was taken up with a baseball game and a series of ludicrous races. Souvenirs were distributed to the children in the party. A barbecue and other refreshments were served at 6.30 o'clock, followed by dancing and motion pictures.

**Wisconsin Electrical Contractors.**—The Wisconsin Electrical Contractors' Association will hold its summer meeting from Aug. 9 to 12, assembling at the Grand View Hotel, Chain O' Lakes, Waupaca, Wis., on Aug. 9. After breakfast the following morning the members will board a chartered boat at Gills Landing and make a trip up river to New London, and further if possible, and returning to Winneconne and Oshkosh, where the meeting will break up.

**Municipal Electricians.**—The twenty-first annual convention of the International Association of Municipal Electricians will be held at Baltimore, Md., on Aug. 22 to 25, next. Convention headquarters will be maintained at the Rennert House, while the sessions of the convention and exhibit hall will be at the Royal Arcanum building, located across the street from the headquarters. On Aug. 26 the convention is invited to visit Washington and inspect the buildings of the Bureau of Standards. Clarence R. George, Houston, Tex., is secretary.

# REVIEW OF TRADE AND MARKET CONDITIONS

*News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods*

## HIGHER COST OF RAW MATERIALS

### Figures Based on Market Values Over Twenty-Month Period Show Surprising Advances

Since the beginning of the war in Europe on Aug. 1, 1914, the prices of raw materials have made some startling increases. With but few exceptions everything has advanced in price.

A. L. Salt, vice-president and general purchasing agent of the Western Electric Company, has compiled for Western Electric News the following figures based on market values of each item over a period of approximately twenty months:

| Material | Increase Per Cent | Material | Increase Per Cent |
|---|---|---|---|
| Acids | 15 | Rings, aerial | 39 |
| Aluminum | 108 | Rubber, crude | same |
| Antimony | 533 | Silk, spun | 65 |
| Batteries, dry | 68 | Silk, tussah | 36 |
| Brass, rod and sheet | 174 | Spelter | 216 |
| Copper | 126 | Steel, Bessemer billets | 123 |
| Dyestuffs | 200 to 2000 | Strand | 77 |
| Fiber | 113 | Thread, linen | 158 |
| German silver | 105 | Tin | 66 |
| Hardware: Pole line | | Tinsel | 25 |
| Cross-arm bolts | 175 | Vermillion | 167 |
| Cross-arm braces | 274 | Vitriol, blue | 329 |
| Guy clamps | 160 | Wire, iron telegraph | 20 |
| Lead, pig | 94 | Wire, outside distributing | 19 |
| Lumber | 20 | Wire, bridle | 35 |
| Paper, cable | 70 | Wire, inside | 27 |
| Platinum | 98 | Yarn, cotton | same |

These increases, Mr. Salt states, can be traced principally to the following causes:

"(1) Decidedly increased requirements in Europe of hundreds of items which cannot be supplied there. (2) Enormous orders placed in this country by European powers for war munitions, motor vehicles, horses, mules, uniforms, food-stuffs, machinery, leather products, iron and steel, etc. (3) Imports and exports curtailed by embargoes and other restrictions making it difficult, and, in some cases, practically impossible, to obtain certain materials from abroad. (4) Suppliers loaded up with orders in the execution of which they are unable to obtain machinery and tools. (5) Transportation facilities taxed to the limit necessitating freight embargoes and causing long delays in transit."

## NEW ENGLAND JOBBING CONDITIONS HEALTHY

### Central Station Construction Work Is Stimulated by Exceptional Industrial Activity—Fan Trade Is Hampered by Inclement Weather During Early Summer

Very healthy jobbing conditions prevail in the New England territory, where the movement of goods is well up to the gage of summer trade. Some difficulty has been experienced on account of slow deliveries, but contractors are inclined to be more patient than they were six months ago, as the whole field of building operations is being retarded by manufacturers being unable to send along the goods. This condition is more pronounced in the plumbing trade than in electrical lines.

Freight conditions have also been troubled to some extent, but traffic movements are freer than they were early in the year and more relief is in sight.

Jobbers report a large amount of central station new construction, such as transmission and power lines, street and house lighting installations, etc. Exceptional industrial activity in many localities has stimulated this type of business to fever heat, and the problem has been to get deliveries of goods fast enough.

The specialty business and the trade in lamps of all types are brisk, but the fan trade is hampered by cool and rainy weather early in the summer. Boston jobbers say that the fan trade must be handled before July 15 or not at all, and hot weather conditions after midsummer seem to have little effect in stimulating new purchases. Though extremely hot weather may follow in late July and August, the fan business apparently will not reach normal this season.

Price conditions are very stable. The jobbing trade has been selling against advancing prices for a year past, and there is no difficulty in getting prices. Collections are fair, though some jobbers point out that when the building trade is as brisk as it is now contractors are apt to overreach their financial capacity and do too much business for their capital. This, of course, makes for some sluggish accounts, though they may be perfectly good ones. The difficulty may be only temporary, and is certainly much less objectionable than the slackness that comes with hard times.

## FRENCH ELECTRICAL FACTORIES ACTIVE IN 1915

### Large Orders for Direct-Current Motors and Hydroelectric Plant Equipment — Prospects Appear Bright for Trade When European War Is Over

There was great activity in the electrical industries of France during 1915, according to an official report made by Consul General A. M. Thackara from Paris. The plants were kept well employed in supplying the heavy demands for electrical material of every kind for the equipment of factories. There were large orders placed for direct-current motors for operating machine tools and other machinery, and important contracts were made for the equipment of hydroelectric plants.

None of the leading French railway companies contracted for new work in 1915, and trade in material for electric railways and tramways was confined almost exclusively to repair work.

There was a notable increase in the manufacture of metal-filament lamps in France during the year, and the output would have been much greater had there not been a scarcity of glass bulbs. But little progress was made in the development of the small power, half-watt lamps for domestic lighting, their use being mostly confined to special purposes for army use. There was an increased demand, however, for half-watt lamps of higher intensity; that is, of 200, 600, 1000 and 2000 cp.

Prices in the electrical lamp trade, which had been seriously depressed by foreign competition before the war, became much more favorable, notwithstanding the great increase in the cost of production. As a rule all the prices for electrical products have advanced considerably. As most of the output was furnished to plants working on war orders the question of prices was not as important as that of steady deliveries.

Consul-General Thackara believes that the prospects for the French electrical industry appear bright and that after peace is restored there will be a period of intensive activity. Many of the important industrial plants, especially mining and metallurgical industries, are situated in the invaded districts and probably have been either destroyed or badly crippled, and for the re-establishment of these plants and for the creation of new industries that are projected for manufacturing in France many products that were imported from enemy countries, a great quantity of electrical and other machinery will be required. The situation, according to the consul, is of intense interest to American manufac-

turers, as they will undoubtedly be called upon to supply many of the wants of the French consumers.

## TRADE WITH SOUTH AMERICA

### Monthly Totals of Electrical Exports from the Port of New York to Principal Southern Republics

Exports of electrical goods to the principal South American countries from the Port of New York, according to compilations made monthly by the foreign trade department of the National City Bank of New York, were the largest during June of any month since last December. The June total was $341,139. The compilation is divided into two groups, i. e., electrical material and electrical machinery. The former includes everything but generators, which are classified as electrical machinery. Figures are given in the accompanying table for every month from September, 1915, to June, 1916, inclusive, except January, 1916, for which the figures are not available. About 85 per cent of the exports of all kinds to South America leave from the Port of New York.

Exports of Electrical Goods to Principal South American Republics

| *Electrical Material* 1915 | Argentina | Brazil | Chile | Colombia | Peru | Uruguay | Venezuela | All others | Total |
|---|---|---|---|---|---|---|---|---|---|
| September | $67,072 | $66,306 | $7,861 | $5,476 | $10,571 | $7,680 | $10,839 | $8,397 | $184,202 |
| October | 76,126 | 48,000 | 7,805 | 39,342 | 19,222 | 8,194 | 8,725 | 2,727 | 210,141 |
| November | 24,848 | 50,778 | 7,363 | 3,486 | 1,668 | 3,290 | 4,034 | 1,112 | 96,579 |
| December | 77,046 | 93,206 | 13,146 | 14,846 | 14,443 | 3,560 | 5,375 | 13,862 | 235,484 |
| 1916 | | | | | | | | | |
| January | | | | (Figures not available) | | | | | |
| February | 42,021 | 114,482 | 11,971 | 13,463 | 6,491 | 11,799 | 2,412 | 2,905 | 205,544 |
| March | 49,848 | 55,927 | 3,317 | 7,962 | 5,694 | 2,702 | 11,343 | 2,077 | 138,870 |
| April | 12,281 | 26,287 | 6,695 | 36,300 | 4,074 | 1,841 | 3,554 | 3,078 | 94,110 |
| May | 29,048 | 27,531 | 9,431 | 29,086 | 10,305 | 6,222 | 8,336 | 3,915 | 123,874 |
| June | 11,338 | 65,963 | 22,118 | 18,324 | 8,786 | 1,203 | 5,524 | 7,634 | 140,890 |
| *Electrical Machinery* 1915 | | | | | | | | | |
| September | $1,825 | $3,093 | $32,828 | $2,081 | ..... | $4,692 | ..... | $181 | $44,700 |
| October | 25,597 | 23,418 | 135 | 2,594 | $6,709 | 3,393 | $665 | 957 | 63,468 |
| November | 25,658 | 21,670 | 27,987 | 5,073 | 2,400 | 3,111 | 1,823 | 1,376 | 89,098 |
| December | 53,639 | 48,465 | 3,023 | 9,962 | 17,632 | 2,242 | 14,854 | 2,558 | 152,375 |
| 1916 | | | | | | | | | |
| January | | | | (Figures not available) | | | | | |
| February | 16,756 | 19,197 | 5,867 | 26,198 | 6,128 | 5,601 | 1,375 | 1,846 | 82,968 |
| March | 32,617 | 23,861 | 7,292 | 16,169 | 7,976 | 4,316 | 36,580 | 19,159 | 147,970 |
| April | 39,792 | 43,632 | 3,137 | 17,020 | 11,094 | 6,366 | 35,289 | 3,178 | 159,508 |
| May | 42,952 | 34,963 | 4,630 | 41,991 | 2,826 | 1,028 | 2,220 | 2,962 | 133,572 |
| June | 35,154 | 104,450 | 11,833 | 16,523 | 9,949 | 4,375 | 12,620 | 5,345 | 200,249 |

The monthly totals of electrical goods to South America have been: September, $228,902; October, $273,609; November, $185,677; December, $387,759; January, not available; February, $288,512; March, $286,840; April, $253,618; May, $257,446; June, $341,139.

## NORWAY NEEDS APPLIANCES

### Because of Increase in Price of Coal, Electricity Is Now Being Used for Heating, Cooking, Washing and Other Domestic Purposes

Owing to the large increase in the price of coal in Norway the demand for electrical appliances is heavy, and American manufacturers have an opportunity to develop there an extensive trade, according to General E. H. Dennison, United States Consul at Christiania. Coal which formerly cost $7.50 per ton now sells for $23.50. As a result the people of Norway are turning to electricity for domestic purposes and the sales of electrical cooking and heating stoves, ranges, washing machines, irons, rings, etc., have never been so large as at present. The demand for these articles is said to be unprecedented and American manufacturers could, it is believed, with little effort improve their position in this market.

It is generally supposed that electric energy in Norway is cheaper than in any other part of the world. It is also thought that coal will be expensive for a long time to come, and perhaps never return to its original price, for Norway depends entirely on outside sources for its supplies. In any event, the sale of electrical appliances, from all appearances, is bound to expand and, when once installed and their many advantages recognized, it is thought that few will care to return to the use of coal. General Dennison reports that he has been requested by one of the largest electrical dealers in Norway to furnish a list of American manufacturers of electrical appliances.

## JOBBING ELECTRIC RANGES

### List Price Prohibits Sufficiently Large Discounts to Allow Satisfactory Profit

There is a feeling which it is possible will some day find concrete expression that list prices on electric ranges are not high enough. This is assuming that the present high grade of construction will continue. Unlike many smaller articles handled by the electrical trade, the price of the electric range known to the public is the manufacturer's list price. The jobber's profit is in the discount.

As the situation now exists, and as was explained in last week's issue of the Electrical World, the jobber gets a discount of less than 45 per cent, the central station less than 40 per cent, and the contractor, dealer and merchant handling electrical supplies a little better than 30 per cent, providing purchases are made of carload lot quantities and that payment is made in less than 30 days. However, few jobbers would ever have occasion to purchase a carload of ranges at one time. This means that the jobber's discount is not greater than that of the contractor or dealer by an amount sufficient to enable him to compete with the manufacturer in this trade. If a contractor wants a single range and does not want to pay for the range until he collects from his customer, in which case he loses the cash discount, the difference between the contractor's discount and that of the jobber who pays cash and buys in large lots would be less than 20 per cent. Take from this the average cost to the jobber of doing business, which has been conservatively placed at 17 per cent, and there is little left to be offered by the jobber to the contractor and dealer above that offered by the manufacturer. If the jobber tries to compete on even terms with the manufacturer the profit, of course, is much too small. Thus the only lucrative market for the jobber is that of every other selling force, namely, the retail market. It is therefore doubtful if his orders will be for any but small quantities, and for which he has a customer. A larger discount, however, with a larger list would undoubtedly tempt him more. The jobber feels that his discounts ought to be such that he can sell to the small merchant and to the contractor small quantities of goods at as good or better prices than the manufacturer and at the same time retain a fair profit. The jobbers say they cannot do it on ranges under present conditions.

In all of the above the most favorable conditions for the jobber were considered. Unfortunately, however, this situation seldom exists. Should the usual case occur, namely, where the jobber gets an order from a dealer for a single range which the jobber orders shipped to the dealer, the jobber's gross profit would probably be very close to 40 per cent. From this must come a discount to the contractor at least as large as the manufacturer would grant or a minimum of 25 per cent, and in most cases 30 per cent. There is then left 15 per cent or less from which to pay all overhead charges and to make a profit. Considered from any angle, the jobber, although he receives a higher discount than any other distributer of ranges, cannot be considered a potent factor in promoting the sale of electric ranges so long as the present list prices and discounts prevail.

# FEDERAL SIGN SYSTEM (ELECTRIC)

## Annual Report Shows Gross Earnings for Twelve Months Ended March 31, 1916, of $1,913,908

While the net earnings for the year ended March 31 last did not reach the volume of 1914-1915, the business for the latter portion of the 1915-1916 fiscal year was much better than for the corresponding period of the preceding year. The greatest improvement in the company's business was in that done with the central stations of the country and this is felt to be most satisfactory, for it is considered the natural market for the company's products.

During the year the company has acquired the controlling interest in Henkel & Best Company, an active corporation devoted to the manufacture of fixtures. The company has itself discontinued the manufacture of fixtures and sold its fixture stock, manufactured and otherwise, to the subsidiary company. This company, during the year, did a good business at a fair profit.

The volume of business for the past year was well sustained, although it is of a character which does not yield as much profit as the class enjoyed by the company in periods when money is plentiful and business normal; notwithstanding, the outlook at present, it is believed, is better than a year ago.

The earnings and expenses for the fiscal year ended March 31, 1916, were as follows:

| | |
|---|---|
| Gross income from operation | $1,913,908 |
| Expenses (including cost of goods bought and manufactured, selling and administrative expenses and depreciation) | 1,831,213 |
| Balance carried to surplus | $82,695 |

# BETTER ELECTRIC SIGN BUSINESS

## Manufacturers Generally Report Number of Sales Larger than in Past Years

On the whole the electric sign business is better than it ever was before. Most manufacturers find themselves more than plentifully supplied with orders. There are, on the other hand, a few sign manufacturers, among whom are some very prominent concerns, who frankly admit that business is not up to expectations. All in all, however, there seems to be a genuine growing demand for this form of advertising.

A certain and by no means small amount of this business can undoubtedly be traced to central station new business activity. The advisability of promoting sign sales was brought out very forcibly at the recent National Electric Light Association convention. And at that time it was clearly demonstrated to what extent the central stations of the country are endeavoring to place signs on their lines.

In specialty signs business has been particularly brisk. The field for electric signs is still far from being extensively developed, and the specialty sign naturally finds a greater opportunity to do business.

Of more than usual interest in this connection has been the exploitation in recent months of the electrically lighted flag. While not an advertisement, this is, of course, an electric sign. From its startling impetus received in Toledo the idea has spread throughout the country, and hundreds and hundreds of electrically lighted American flags have been sold. While it is very doubtful how long this business will last, it is certain to be large so long as the spirit of national preparedness and rumors of war exist.

In some localities the electric sign business has received a decided setback. A number of cities have passed restrictive measures that take away most of the best selling points of electric signs. Until these laws are repealed it is felt that there will be very little business in these places.

In regard to prices there seems to be a great difference of opinion. All manufacturers agree that prices should be higher, but a large number have hesitated to make any advance. Where it has been possible economies have been effected to offset to as large a degree as possible increased manufacturing costs. The reason these manufacturers have not advanced their prices, they plainly state, is because the consumer, they find, will not pay the price. They point out that inquiries are large but buyers hesitate to pay more than they would have had to pay formerly. Some manufacturers who advanced their price have been forced to recall the increase because the consumer refused to pay the additional amount. The majority of manufacturers, however, have made some increase, some of whom stated that they found that the consumer did not hesitate at the price provided the sign was attractive, substantial and suitable.

In addition to labor, which has advanced in this trade about 25 per cent, the cost of manufacture is much more than it was two years ago. The general estimate is that about 40 per cent will probably cover the increased cost. Sheet iron, galvanized products, wire, glass, porcelain, etc., cost much more than formerly.

On special orders, of course, deliveries have been lengthened out to correspond to the deliveries of raw materials. On stock signs, however, it has been possible, as a rule, either to ship from stock or on deliveries slightly longer than normal. In this class of goods a large number of signs are always being made up into stock; and since the trade is not swamped with orders, it can, as a rule, make very satisfactory shipments under prevailing conditions. Freight embargoes have been the cause of some long deliveries, both of the finished product and of the raw materials.

Credits and collections are about normal, which is better than they have been. As a large number of signs are sold on long credit terms, this is a very vital part of the business, and it is more than likely from present conditions that manufacturers will begin shortly to tighten up on credits. Should a serious business depression again visit this country shortly it is feared that many manufacturers would find themselves in a very unfortunate position. In the last depression the large number of bankruptcies and failures threw back on the manufacturers' hands unpaid-for signs that had little if any sales value.

It is expected that the electric sign business will continue to improve. The hardest thing to do is to place the first sign in a town. After that it is easier sailing. Because of the greater number of towns that now have one or two, or more, signs it is believed that the coming months will see a still greater improvement in business.

# ELECTRIC REFRIGERATING MACHINES IN DEMAND

## Volume of Buying During First Half of 1916 Far Exceeded Production Ability—Prices Higher and Deliveries Generally Longer

Although a comparatively new article, the electrical refrigerating machine has found a large and ready sale. Orders have been coming in faster than it is possible to produce the machines. Of course to a certain extent this is owing to the difficulty in obtaining the necessary raw products in sufficient quantities or promptly. The demand, however, has been unprecedented. One firm in answer to an inquiry from the ELECTRICAL WORLD regarding business conditions in this line wrote:

"We are not doing any advertising at present, and will not do any for probably six or eight months; that is, on an extensive scale, because our sales are now greatly in excess of our output."

Prices have gone up considerably owing principally to the increased cost of labor, raw materials and manufactured shapes.

Deliveries in most cases are much longer than under normal conditions. The enormous volume of business and the abnormally long deliveries of products used in the manufacture of the machines have accounted for this condition. Some manufacturers, however, in anticipation of a large buying movement, stocked up heavily not only in materials of manufacture but in the completed machines. These companies, of course, will be able to make immediate deliveries.

Credits and collections are particularly good, although there has been a tendency to shorten upon the time of credit.

Not only is business good now, but the prospects for a sustained business are excellent. The public is rapidly becoming educated to electrical refrigeration. Its superiority to ice refrigeration is being more and more recognized.

## Manufacturing and Industrial

**The Mechanical Rubber Company** has transferred its advertising department to 1790 Broadway, New York.

**The Sanford Riley Stoker Company** has moved its main offices from 72 Commercial Street, Worcester, Mass., to larger quarters at 25 Foster Street.

**The Wagner Electric Manufacturing Company, St. Louis, Mo.**, has moved its Detroit office to 1291 Woodward Avenue. Dean Emerson will remain in charge of this office.

**The Blaw Steel Construction Company.**—John Bennett Bissell, formerly president of John Bennett Bissell, Inc., exporter, has resigned his position to join the organization of the Blaw Steel Construction Company. Mr. Bissell will be manager of the export department and the Eastern structural sales department with headquarters at 165 Broadway, New York.

**New Chicago Plant for Hughes Company.**—The Hughes Electric Heating Company of Chicago has plans under way for the erection of a new $150,000 factory at Waller Avenue and Taylor Street, Chicago, having outgrown the facilities of its present factory location. The new plant will be modern in every sense and designed to expedite efficient manufacturing and shipping.

**The Trumbull Electric Manufacturing Company**, Plainville, Conn., has appointed W. T. Naser manager of its Chicago office to succeed J. S. Jacobson, who has recently resigned. Mr. Naser was formerly manager of the company's San Francisco office. The Trumbull company will close its factory during the week of July 17-22 for general repairs and an annual vacation for its employees.

**Delco Salesmen Meet.**—The salesmen of the Delco Light System for central Ohio held a two-day convention at the company's office in Columbus on July 6 and 7. J. J. Munsell, general agent for this territory, was in charge of the affair, and R. H. Grant, general manager of the Domestic Engineering Company of Dayton, Ohio, manufacturer of the apparatus, was the principal speaker. Twenty salesmen and agents were present.

**Garford Manufacturing Company Sells Telephone Equipment Business.**—The Stromberg-Carlson Telephone Manufacturing Company has purchased the telephone equipment business of the Garford Manufacturing Company of Elyria, Ohio, formerly the principal feature of the old Dean Electric plant, as well as the machinery, tools and material of the department. Rapid expansion in other lines made the disposal of this branch of the business desirable, it was stated.

**The Meriam Company** has moved from 235 Superior Avenue, to 1514 Prospect Avenue, Cleveland, Ohio. The business of this company has been growing very steadily, it is reported, and consequently has necessitated new and larger quarters. The company has recently brought out a line of gas carburetors for block test of automobile and marine engines, a manometer, a gas economy indicator and a flow meter. Besides manufacturing various types of instruments the concern is acting as distributer for the Carter carburetor and Carter gravity tank. It also represents several manufacturers of power-plant instruments.

**Federal Legislation on Bills of Lading.**—The House of Representatives committee on interstate and foreign commerce has favorably reported the bill on bills of lading which is being urged by the American Bar Association and the Chambers of Commerce of the United States and others. Some amendments have been made to the text of the bill as it passed the Senate, the one of most general interest probably being the substitution of new language in the section which deals with the notation of "shippers load and count" on bills of lading when a shipper has himself loaded the car. As now expressed the bill will permit only a shipper of bulk freight, who himself does the loading and who maintains adequate facilities for weighing, to which the carrier has access, to require by a written notice that the carrier ascertain the kind and weight of the shipment and give a bill of lading which assumed responsibility for the description of the shipment.

**Large Orders for Electrical Apparatus.**—For installation in the Curtis Bay substation at Baltimore, the Baltimore & Ohio Railroad Company has recently purchased from the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., three 500-kw. rotary converters, three 500-kva. transformers; four 50-kva. transformers, and one seventeen-panel switchboard. This substation will supply energy to the Curtis Bay coal pier, one of the largest coal piers in the country. Energy will be furnished to the substation by the Baltimore Consolidated Gas & Electric Company. An order amounting to approximately $90,000 has also just been received by the Westinghouse company, from the Chili Exploration Company, for two 450-hp., self-starting, three-phase, 50-cycle, 500-volt, synchronous motors for compressor service, with shoe rails, dampers and starting auto-transformers for 100-per cent. power factor operation; two 10-kw., 125-volt, 1080-r.p.m. exciters, and two starting panels, to be installed at Antofagasta, Chili. For mining and smelting service the Utah Copper Company and its allied interests have placed orders for 211 vertical agitator motors for separating copper from low-grade ore and tailings by the use of the flotation system; the Tacoma Smelting Company has ordered ten complete equipments, consisting of motor-generators, transformers and switchboards, for precipitating smelting fumes by the Cottrell process, and the Butte & Superior Copper Company has placed orders for a flywheel motor-generator, direct-current hoisting equipment. Equipments similar to that purchased by the Butte & Superior Copper Company have also been sold to the United Verde Company, Jerome, Ariz., and the Hercules Mining Company. Contracts for the complete electrical equipment for three large double-leaf bascule lift bridges for the City of Seattle have been awarded to the Westinghouse company. These bridges will span the Lake Washington Canal and will be among the largest of their type yet built, it is claimed. Each bridge will have a total over-all length of 291 ft., with a 200-ft. span, and will be 60 ft. above the water. The electrical equipment for each bridge will consist of four 100-hp., main operating motors together with a smaller motor for operating the center lock. Two main operating motors will be connected permanently in series on each leaf and will have switches so that if one motor fails it may be cut out and the other motor left to operate the bridge. Either motor alone will be capable of raising the leaf at reduced speed. The motors on each leaf will be controlled by a magnet-switch controller regulated by a master switch in an operating house on the leaf. There will be an operating house on each leaf, designated as "north" and "south" operating house. Control panels and master switches will be installed in each house. Each main operating motor will have a weatherproof brake mounted on it. For the center lock a varying-speed, series-wound, direct-current motor will be used operated by a drum controller located in the "south" operating house. The installation and erection work will be done by local sub-contractors in Seattle. Among other orders recently received by the Westinghouse Electric & Manufacturing Company is one from the Rochester (N. Y.) Railway & Light Company for its new hydroelectric plant in Rochester, for two 12,500-kva., 11,000-volt, three-phase, 60-cycle, 180-r.p.m., vertical alternating-current generators with directly connected exciters, and from the Pennsylvania Lines West for four 600-amp. electric arc welding equipments.

### NEW YORK METAL MARKET PRICES

| | July 3 — Selling Prices Bid | Asked | July 11 — Selling Prices Bid | Asked |
|---|---|---|---|---|
| | £ s d | | £ s d | |
| London, standard spot | 101 15 0 | | 88 0 0 | |
| Prime Lake | 26.25 | to 26.75† | 26.00 | to 26.50† |
| Electrolytic | 26.00 | to 26.50† | 25.50 | to 26.00† |
| Casting | 23.87½ | to 24.12½† | 23.50 | to 23.75† |
| Copper wire | 29.00 | to 31.00† | 29.00 | |
| Lead | 7.00 | | 6.50 | |
| Nickel | 45.00 | to 50.00 | 45.00 | to 50.00 |
| Sheet zinc, f.o.b. smelter | 18.00† | | 17.00 | |
| Spelter | 10.67½ | to 11.17½ | 8.92½ | |
| Tin, straits | 39.37½† | | 38.50 | |
| Aluminum, 98 to 99 per cent. | 58.00 | to 60.00† | 57.00 | to 59.00† |

### OLD METALS

| | | | | |
|---|---|---|---|---|
| Heavy copper and wire | 17.00 | to 18.00† | 17.00 | to 17.50† |
| Brass, heavy | 10.50 | to 11.00† | 10.50 | to 11.00† |
| Brass, light | 9.00 | to 9.50† | 8.50 | to 9.00† |
| Lead, heavy | 5.25 | to 5.50† | 5.00 | to 5.25† |
| Zinc, new scrap | 9.00 | to 9.50† | 8.00 | to 8.25† |

### COPPER EXPORTS

Total tons to July 11 ..... 4,913

†Nominal.

## Corporate and Financial

**Dayton (Ohio) Power & Light Company.**—A block of 6 per cent cumulative preferred stock is being offered at 96 and accrued dividend.

**North American Light & Power Company, Moberly, Mo.**—A new issue of $50,000 of three-year 6 per cent. first lien and refunding collateral trust gold notes due on May 1, 1919, has been sold at par and interest.

**Southern California Edison Company, Los Angeles, Cal.**—In his annual report to the stockholders for the year ended Dec. 31, 1915, John B. Miller, president of the company, states: "The uncertainty as to what either the continuance of the war or its cessation might bring forth, has made it seem wise to your board to follow a very conservative policy and keep your company in as strong a position as possible without in any way neglecting any precautions for insuring the continuity and excellence of the service and always having a due regard toward meeting the reasonable demands of the public for extensions. While this section of the country has not benefited as have other sections in a business activity due to so-called war contracts, signs of improvement in business conditions have been apparent, and a somewhat more liberal policy of extensions for new business has prevailed during the last few months of the year. Under these circumstances, the statement of earnings should be regarded as favorable. During the year the company contracted service to 18,125 hp. in motors, 236,629 50-watt equivalent in lamps, and 11,535 kw. in lamp socket appliances; a combined additional load contracted for amounting to 36,960 kw., or 49,280 hp. The fact that notwithstanding the business depression prevailing during the greater part of the year, the above large amount of business was added to our lines and the additional fact that the total power developed by companies operating in this section of southern California is approximately 250,000 hp., is convincing evidence of our belief that the company will always have a lucrative market for its output. It should be borne in mind, too, that notwithstanding the very substantial amount of new business added, this added business is not at present reflected in the earnings—the result of a curtailed use by consumers due principally to the general business depression. As general conditions more nearly approach normal this added load will, without any additional expenditures for connections, show considerable increases in earnings." The statement of earnings for 1915 compared with 1914 was given as follows:

| | 1915 | 1914 |
|---|---|---|
| Gross earnings | $4,933,116 | $4,855,140 |
| Operating expense | 2,218,618 | 2,332,164 |
| Net earnings | $2,714,498 | $2,522,976 |
| Interest and amortization | 1,003,181 | 892,010 |
| Balance | $1,711,317 | $1,630,966 |
| Reserve for depreciation | 700,000 | 700,000 |
| Balance | $1,011,317 | $930,966 |
| Dividends and miscellaneous charges | 928,625 | 921,896 |
| Balance | $82,692 | $9,070 |
| Previous surplus | 230,942 | 221,872 |
| Surplus | $313,634 | $230,942 |

**Virginia Railway & Power Company, Richmond, Va.**—At the annual meeting of the company to be held on July 20 the stockholders will be asked to approve an increase in the authorized amount of preferred stock from $8,000,000 to $9,000,000, the additional stock to be issued as required for improvements, extensions and betterments. The company at the present time has $7,698,400 of preferred stock outstanding.

**Wisconsin Power, Light & Heat Company of Milwaukee, Wis.**—This company has been organized to merge the properties at Beaver Dam, Fox Lake, Horicon, Berlin, Omro, Portage, Baraboo, Cambria, Pardeeville, Green Lake and Neshkoro in southwestern Wisconsin. The Wisconsin Railroad Commission has authorized a $1,000,000 stock issue and a $2,065,000 bond issue, the immediate proceeds of which will be used to construct a new 15,000-kw. steam generating station at Portage, and transmission lines to the value of approximately $1,000,000 to join the several properties, and to retire the underlying bonds against the present property. The company is a subsidiary organization to the Central Utilities Securities Corporation, which also controls the Wisconsin River Power Company at Prairie du Sac, and the Southern Wisconsin Power Company at Kilbourne, which are water power properties and will be operated in conjunction with the new steam plant at Portage. The better plants on the small properties will be continued in operation, while others will be shut down. John I. Beggs will be president of the new company, and the directors, while not yet announced, it is understood will be Milwaukee and Chicago men.

**Western Canada Power Company, Ltd.**—The gross earnings of the company for 1915 were $316,554 and the operating expenses were $89,627, leaving a credit balance of $226,927, this balance being insufficient to meet the interest on the first mortgage bonds, which amounted to $250,000, while interest on the refunding mortgage bonds of the company and interest payable on current account were not earned by the company. The loans to the company secured by pledges of its first mortgage bonds and the other net current liabilities of this company amount to nearly $550,000. The company will require, in addition, $100,000 to install the third generating unit. A protective committee in New York City, representing the holders of the notes, which are secured by the refunding mortgage bonds of the company, was able to effect a compromise with the committee representing the holders of the first mortgage bonds, whereby it is proposed among other things: That the holders of the first mortgage bonds will convert two years' interest coupons amounting to $500,000 into debentures of the company, payable in ten years, with interest at the rate of 7 per cent per annum; and that the holders of the notes, secured by refunding mortgage bonds, will procure these bonds to be converted into ordinary shares of the company, and thereupon cancelled, and that an issue of preferred shares shall be made and sold to realize sufficient to pay off all current liabilities of the company, and to provide sufficient funds for the installation of a third generating unit in the company's power house at Stave Falls. In order to carry out the terms of this compromise, and to avoid the sale of the company's properties in foreclosure proceedings, it is necessary that the holders of the $2,495,000 par value of the shares of the company, now issued to the public, should subscribe for a sufficient number of the proposed new issue of preferred shares to realize $374,240 in cash. It is, therefore, proposed, at the ensuing annual meeting of the company, to be held on July 15, to enact by-laws reducing the paid-up capital of the company from $5,000,000 to $1,000,000, and to issue to each shareholder one fully paid share for each lot of five fully paid shares, now held by him. The noteholders' protective committee has procured the formation of a syndicate in New York City, which will underwrite an issue of at least $850,000 of preferred shares, and the noteholders' protective committee will offer these preferred shares to noteholders and to the shareholders at the price of $80 per share. Each shareholder is requested, for each lot of five shares now held by him, to subscribe for at least two new preferred shares of the par value of $100 each, and to pay therefor $80 per share, in cash, and, upon such payment being made, each shareholder, in addition to receiving out of the reduced capital stock of the company, one share in five of his present holdings, will, in case the issue of preferred shares is not over-subscribed, receive from the noteholders' protective committee four additional fully paid ordinary shares of the company for every two preferred shares allotted to him. In other words, in case the issue of preferred shares is not over-subscribed, a present holder of five ordinary shares of the company, who subscribes and pays for at least two preferred shares, on the terms mentioned above, will, in the reconstruction of the company, obtain the same number of ordinary shares as he now holds. The company, which now has $9,000,000 of mortgage bonds of both classes outstanding will, after its reconstruction as proposed, have only $5,000,000 first mortgage bonds outstanding; the refunding mortgage bonds being converted into ordinary shares. There will be $5,000,000 of ordinary shares as at present, and the $850,000 of preferred shares and $500,000 of debentures will largely represent additional moneys subscribed and paid into the treasury of the company.

## New Utility and Industrial Companies

**The Cedar Point (Ohio) Utilities Company** has been incorporated with a capital stock of $10,000 by E. B. King, R. K. Ramsey, H. A. Dunn and others.

**The Hanover (Kan.) Light & Power Company** has been incorporated by Henry B. Collier, J. A. Hopkins and others to supply electrical service in Hanover.

**The Marvell Electric Light & Power Company** of Marmaduke, Ark., has been chartered with a capital stock of $15,000 by A. Bertig, S. Bertig and others.

**The Petersburg (Mich.) Electric Light & Power Company** has been incorporated with a capital stock of $5,000 by William Schroeder, William L. McAran and others.

**The Highland Light & Power Company** of Green, Kan., has been granted a charter with a capital stock of $40,000. The incorporators are: J. S. Barry, William Steinfeldt and others.

**The Bondville (Ill.) Electric Company** has been granted a charter with a capital stock of $1,500 to supply electricity in Bondville by J. C. Flowers, G. B. Talbott and others.

**The Perry (Ill.) Light & Power Company** has been incorporated by J. I. Vertrees and others. The company is capitalized at $5,000 and proposes to supply electricity in Perry.

**The S. & F. Protection Auto Light Company** of Lawrence, Mass., has been incorporated with a capital stock of $10,000 by Edward McAnahy, Louis E. Stevens and Edgar M. Earley.

**The Hale Light & Power Company** of Fairfield, Ala., has been incorporated with a capital stock of $10,000. The officers are: E. P. Kimbrough, president, and M. H. Murphy, secretary and treasurer.

**The North Coventry (Pa.) Electric Company** has been incorporated with a capital stock of $5,000 to operate in North Coventry Township. J. C. Murtagh of West Chester is one of the incorporators.

**The Citizens' Electric Light & Power Company** of Poplar, Mont., has been incorporated with a capital stock of $40,000. The incorporators are: J. M. Stewart, James MacDonald, James Helmer and Linden O. Johnson.

**The Quick Action Ignition Company** of South Bend, Ind., has been incorporated by Otto R. Beyler, Gilbert R. Dunkle and Emil E. Hawkinson. The company is capitalized at $450,000 and proposes to manufacture electrical machinery.

**The Rock Light Company** of Queens, N. Y., has been incorporated by E. B. and W. F. Rockstrob and L. Kornfield, 56 Oxford Avenue, Richmond Hill, N. Y. The company is capitalized at $5,000 and proposes to manufacture and deal in lamps, machinery, etc.

**M. Watkins & Company** of Brooklyn, N. Y., has been incorporated with a capital stock of $30,000 for the purpose of manufacturing and dealing in sewing machines, electric motors, power tables, etc., by A. M. and M. Watkins, 8705 Parkway, Brooklyn, N. Y.

**The Clemens Electrical Corporation** of Buffalo, N. Y., has been incorporated with a capital stock of $10,000 to manufacture and deal in electric fuses, soldering irons, buzzers, transformers, etc. The incorporators are: L. E. Levee, J. G. Clemens and L. G. Smith of Farnham.

**The Southern Iowa Electric Company** has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000. The principal office is located in Wilmington, Del., and western office is in Omaha, Neb. Walter B. Roberts is secretary.

**The Sumpter Power & Water Company** of Spokane, Wash., has been incorporated with a capital stock of $100,000 for the purpose of developing power and to distribute water and electricity for lamps and motors. The incorporators are: R. E. Strahorn, A. G. Smith and R. J. Danson of Spokane, Wash.

**The C. W. Kalb Electric Company** of New York, N. Y., has been incorporated by J. F. Sandhoff, W. S. Davis and C. W. Kalb, 150 Nassau Street, New York, N. Y. The company is capitalized at $10,000 and proposes to do a general contracting and mechanical engineering business, construction and development work.

**The Comment Light Company** of Beaver Falls, Pa., has been chartered with a capital stock of $5,000 to operate in Moon Township by J. R. McNary and G. H. Pifer of Pittsburgh, Pa.; F. S. Miller of Jeannette and others.

**The Chotaw Power & Light Company** has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000 for the purpose of generating and distributing electricity for lamps, heaters and motors. The incorporators are: Herbert E. Latta, Henry Farrow, Clement M. Egner, local Wilmington (Del.) incorporators.

**The Essex Electric Company** of St. Johnsbury, Vt., has been chartered with a capital stock of $200,000 by Theodore W. Chase of Passumpic; Fred D. Gilman, Harry H. Carr, Truman A. Pierce and Charles C. Braley, all of St. Johnsbury. The company proposes to develop water powers and build storage reservoirs on the Moose River and its tributaries in Caledonia and Essex counties in Vermont.

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## Trade Publications

**Filters.**—The Famous Filter Company, 308 North Commercial Street, St. Louis, Mo., has prepared catalogs descriptive of its oil filters and gravity oiling systems.

**Chandeliers.**—The Beardslee Chandelier Manufacturing Company, Chicago, Ill., is sending out pencil sketches of ornamental lighting fixtures designated as F-6-1 to F-6-4 inclusive.

**Ball Bearings for Cottonseed-Oil Machinery.**—The S K F Ball Bearing Company, Hartford Conn., has just published an attractively illustrated bulletin on ball bearings for cottonseed oil machinery.

**Electric Heating Stove.**—The Stoneware Electric Stove Works, Dover, N. J., has just issued illustrated folders which contain information on several types of small electric heaters which were recently described in these columns.

**Regulator Electric Iron.**—The Reimers Manufacturing Company, 130 Church Street, New York, is sending out an illustrated leaflet which contains information on its new electric iron provided with regulating lever for changing the amount of heat while in use.

**Trolley-Line Material and Reversing Planer Motors.**—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued Leaflet No. 3554-A on its reversing planer motors and descriptive Leaflet No. 3881 on several types of trolley-line materials.

**Soot Cleaners.**—The Vulcan Soot Cleaner Company, Du Bois, Pa., has prepared an attractively illustrated catalog descriptive of its soot cleaners. The catalog also contains considerable information on various kinds of soot and the application of the Vulcan soot cleaners to different types of boilers.

**Electric Ranges.**—The Hughes Electric Heating Company of Chicago has issued its first number of "Daisy Dayload," which is to be published once a month and distributed to every central station company in the United States and Canada. Each issue will contain some pertinent information regarding the relation of electric cooking to the central station manager's load, and also accounts of special selling campaigns of electric ranges.

**Fans, Motors and Generators.**—The Colonial Fan & Motor Company, Warren, Ohio, has just brought out its 1916 catalog descriptive of alternating-current and direct-current desk, oscillating and ceiling types of fans. It has also published Bulletin No. 43 on direct-current bi-polar generators and motors with fractional-horsepower ratings, Bulletin No. 41 on single-phase alternating-current motors, and Bulletin No. 40 on motors and generators of the multi-polar types.

**Circuit Breaker Installations.**—Under the title "Typical I-T-E Circuit Breaker Installations" the Cutter Electrical & Manufacturing Company, Philadelphia, Pa., has assembled some interesting material regarding its product. The book is above the average trade literature in its method of presenting data regarding the Cutter Company's products. Many typical switchboard installations and examples of engineering skill in their respective fields of application are illustrated. The engineering data of some of the most notable plants are of value. The perfection of mechanical detail adds to the appeal of the volume.

## New England

AUGUSTA, ME.—The Vassalboro, China & Windsor Light & Power Company has applied to the Public Service Commission for permission to issue $30,000 in capital stock and $40,000 in bonds, the proceeds to be used to acquire real estate, water power privileges and water wheelpits, generators, switchboards, pole lines, etc.

BIDDEFORD, ME.—The Public Utilities Commission has approved the petition of the York County Power Company of Biddeford to issue $51,000 in bonds.

JEFFERSONVILLE, VT.—The Village Trustees have granted the Public Electric Light Company of St. Albans permission to erect transmission lines in Jeffersonville to furnish electricity here.

LUDLOW, VT.—The Electric Light Commissioners have applied to the Public Service Commission to grant them a right of way through certain lands to enable them to erect a transmission line to connect the municipal electric-lighting system with the lines of the Colonial Power & Light Company of Claremont, N. H.

BOSTON, MASS.—Bids will be received by the State Board of Insanity (Michael J. O'Meara, M. D.), State House, Boston, Mass., until July 19, for construction of the following buildings: Boston State Hospital, (a) women's custodial building, separate bids for heating, plumbing and wiring; (b) for fire escapes on male infirmary building; (c) extensions to sewer and water systems. Wrentham State Hospital, (d) for dormitory; (g) separate bids for erection, heating, plumbing and wiring. Danvers State Hospital (e) Nurses' Home, separate bids for erection, heating, plumbing and electric wiring; (f) for store house and service building; separate bids for heating, plumbing, wiring and elevators, etc. Westboro State Hospital (g) alterations to Wards 1 and 4; separate bids for heating, plumbing and wiring. Massachusetts School for Feeble-Minded (h) Recreation Building, erection only. Separate bids for each building in each group. Kendall, Taylor & Co., 93 Federal Street, Boston, Mass., are architects.

WINCHENDON, MASS.—The property of the Winchendon Electric Light & Power Company, including the power station in Centreville and Whitney and all water rights, except at Woodcock Mills, in Waterville, has been purchased by C. D. Parker & Company of Boston. Mr. Whitney of the Winchendon power company has entered into a 20-year contract with the new owners to furnish power at his machine shop. F. W. Nourse has been retained as manager.

PROVIDENCE, R. I.—The Darrow Mann Company, of Boston, Mass., coal dealers, has leased a portion of the harbor sea wall and will install a coal-handling plant. About $300,000 will be expended, including $50,000 for equipment.

GROTON, CONN.—The contract for furnishing electricity at the United States submarine base and navy station at New London, Conn., has been awarded to the municipal electric plant at Groton.

## Middle Atlantic

BATAVIA, N. Y.—The City Council has decided to reject bids submitted under items Nos. 10 and 16 of the specifications, for street lamps and fixtures, because the type of 100-cp. lamps is considered unsatisfactory. New bids will be asked for when the Council decides upon the style and capacity of lamp desired.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has obtained control of the Hobart farm, west of Johnson City, on which it will erect a new power plant, to cost about $500,000. The plant will be synchronized with the power plants of Endicott, Johnson & Company, thereby affording the shoe factory power in case of emergency. The present power station in Binghamton will serve as an auxiliary plant. The company is under the management of W. S. Barstow & Company of New York.

CANISTEO, N. Y.—Arrangements are being made by the Canisteo Light & Power Company, recently organized, to install an electric plant to supply electrical service here. The engine room of the Superior Register Company, it is understood, will be used as a power station by the company. C. A. Larrowe, L. A. Walsh and others are interested.

CORTLAND, N. Y.—The Cortland County Traction Company is contemplating the installation of a 1500-kw. General Electric steam turbine with one Wheeler, jet type, condenser.

DUNKIRK, N. Y.—The report of F. W. Ballard, consulting engineer, of Cleveland, Ohio, to the City Commissioners recommends extensions and improvements to the municipal electric-light and water station, involving an expenditure of about $200,000. He also recommends purchasing outright the franchise of the Dunkirk Electrical & Power Company, now controlled by A. W. Cummings.

RIPLEY, N. Y.—The Public Service Commission has approved the construction of an electric-light plant and distribution plant by Alfred Huntington and the exercise of a franchise in the fire district of the town of Ripley. Mr. Huntington has purchased the property of the Ripley Electric Company which operates in part of this district.

SYRACUSE, N. Y.—Plans are being considered for the installation of new lighting system in James Street. At present there are 25 arc lamps on the thoroughfare and it is proposed to replace them with about 140 incandescent lamps.

DU BOIS, PA.—The installation of an ornamental street-lighting system in Du Bois is under consideration by the City Council.

HARRISBURG, PA. — Charters have been granted by the State Department to the following companies: The Lykens Township Electric Company, Heigens Township Electric Company, Berrysburg Electric Company, Hubley Township Electric Company, Killinger Electric Company and Mifflin Township Electric Company. Each company is capitalized at $5,000. John Pfeiffer of Tower City, Pa., is treasurer of all of the companies.

MONACA, PA.—The borough of Monaca has engaged H. O. Swoboda, Empire Building, Pittsburgh, as consulting engineer for the purpose of conducting negotiations with the local electric-light company. The Borough Council, it is reported, is contemplating taking over the franchise held by the company.

NEW CASTLE, PA.—Charters have been granted to 13 new electric companies to operate in the western part of the State, with headquarters in New Castle. The companies are to operate in the districts for which they are named and are given the name of Lawrence after the town name, as follows: They are the Bessemer Borough, New Wilmington, Hickory Township, Mahoning Township, Neshannock Township, North Beaver Township, Perry Township, Pulaski Township, Taylor Township, Union Township, Wilmington Township and Wampum Lawrence Township Electric Companies. Each company is capitalized at $10,000. The incorporators are: J. C. Chesnut, L. B. Round, C. H. Akens, H. M. Wood and M. Pendleton, all of New Castle.

NEW OXFORD, PA.—The Borough Council has granted the Hanover (Pa.) Light, Heat & Power Company a franchise to construct and operate an electric-light plant in New Oxford for a period of 30 years. The company was also given a five-year contract for street-lighting under which it is to furnish four 250-cp. and thirty 50-watt lamps.

YORK, PA.—The City Council is considering the installation of a new lighting system on George and Market Streets.

BLOOMFIELD, N. J.—Plans are being prepared by the architects of the Sprague Electric Works of the General Electric Company for the construction of a new building in the Watsessing section of Bloomfield, to cost about $500,000.

HAMMONTON, N. J.—The fire, water and light committee of the Hammonton Council has recommended that gas lamps which are in use on certain streets be discontinued and electric incandescent lamps be substituted.

PATERSON, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 8, for conduit and wiring system, lighting fixtures, etc., in the United States post office at Paterson, N. J. For details see proposal columns.

VINELAND, N. J.—Plans and specifications prepared by Lewis & Roth of Philadelphia, Pa., electrical engineers, for extensions and improvements to the municipal electric-light plant (to cost from $70,000 to $80,000) have been approved by the Borough Commissioners. It is understood that bids will soon be asked for the work.

FEDERALSBURG, MD.—The electric plant and flour mill of the Idlewild Electric Light, Heat & Power Company of Federalsburg was recently destroyed by fire, causing a loss of about $15,000.

ST. MICHAELS, MD.—The City Council is considering issuing $8,000 in bonds for the installation of an electric-light and power plant.

WHITEHALL, MD.—Preparations are being made, it is reported, by M. N. Faulk, John F. Wiley and John P. Mays for the erection of a transmission system to supply electricity for lamps and motors. Energy to operate the system will be obtained from the generating station of the Fiber-Fabric Company.

RICHMOND, VA.—At the annual meeting of the Virginia Railway & Power Company of Richmond, to be held July 20, the stockholders will be asked to approve an increase in capital stock from $8,000,000 to $9,000,000, the proceeds to be used for improvements and extensions to the system.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 9872—four fireroom hoist engines, four turning gear motors; Schedule 9885—miscellaneous desk and bracket fans. Boston, Mass., Schedule 9874—miscellaneous condenser, circulating, etc., pumps. Philadelphia, Pa., Schedule 9873—6000 ft. interior communication cable, 2175 ft. telephone cable. Various navy yards, Schedule 9880—miscellaneous globes, miscellaneous prismatic reflectors; Schedule 9879—45,000 weatherproof sockets. Mare Island, Cal., Schedule 9875—two induction motors. Norfolk, Va., Schedule 9870—14 disconnecting and oil switches, and three 500-kw. transformers. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Commerce reports as follows: No. 21,575—The bureau is informed that the government of one of the Latin-American countries is interested in the purchase of wireless field telephone installations and equipment for distances of about 100 miles. Catalogs with price lists and full particulars should be sent to consular representative in the United States. No. 21,610—An American consular officer in Canada reports that a newly organized company for the manufacture of thrashing machines in his district is in the market for certain woodworking and metal-working machinery and electric motors, etc. A complete list of the equipment may be obtained from the bureau or its district offices. No. 21,611—A business man in South Africa informs an American consular officer of his desire to secure the exclusive agency for small ice-making plants suitable for stores, hotels, dairy and fruit farms. No. 21,665—The commercial attaché of the Department of Commerce in Russia reports that a firm in the Caucasus district desires to enter into commercial relations with American manufacturers of cotton gins, etc., sawmill installations, electric motors, refrigerating machinery, wire-rope machinery, etc. No. 21,670—An American consular officer in Norway reports that an agent in his district desires the agency for an automobile not already represented in that country. The man is particularly interested in electric and gasoline trucks. Correspondence may be in English. No. 21,713—A firm in France informs an American consular officer that it desires to represent American manufacturers of household requisites, such as electric irons, meat choppers, coffee mills, etc. No. 21,715—An American consular officer in Spain reports that a manufacturer of electric materials and sanitary articles is in the market for electrical apparatus, bell fixtures and plumbers' supplies. Correspondence may be in English. No. 21,748—The representative of a company, recently organized in France for the purpose of developing trade between the United States and France, Italy and Spain, desires to enter into direct commercial relations with American manufacturers of pharmaceutical products, moving-picture films, electric magnetos, machinery, etc. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches.

## North Central

CALUMET, MICH.—Bids will be received by the Board of Education, Calumet, Mich., until July 24 for construction of grade school building, separate bids to be submitted as follows: General construction, heating and ventilating, heat regulation, plumbing, sewering and gas fitting, electric wiring, clock gong and fire signal systems. Plans and specifications are on file in the office of Edward Ulseth, Calumet and at the office of John D. Chubb, archi-

# *Construction*

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

tect, 109 North Dearborn Street, Chicago, Ill. J. W. Downing is secretary of school board.

DETROIT, MICH.—Bids will be received by George H. Fenkell, commissioner of public works, Detroit, until July 24, for furnishing equipment for the new municipal court building. Separate proposals to be submitted on electric-lighting fixtures and electric clock system.

PONTIAC, MICH.—Plans are being prepared by Leo J. Heenan, architect, for extensive improvements to the old Welch plant on South Saginaw Street, for the Monroe Motor Company. The work will include the erection of new power house, shipping docks and installation of sprinkler and heating systems.

AKRON, OHIO—The Akron Belt Line Railroad Company, recently incorporated with a capital stock of $250,000, is planning to build an electric railway from Akron to New London.

AKRON, OHIO—The Northern Ohio Traction & Light Company of Akron has applied to the Public Utilities Commission for permission to issue $14,075,000 in bonds, the proceeds to be used to refund outstanding bonds, retire present obligations of the company and for proposed improvements, to cost approximately $1,955,300.

BOWLING GREEN, OHIO.—Bids will be received by J. E. Shatzel, secretary of the board of trustees of the Bowling Green State Normal College, Bowling Green, until July 21 for various work in construction of a new fireproof building, including electrical equipment and fixtures.

CINCINNATI, OHIO.—The board of trustees of the Young Men's Christian Association has acquired a 54-ft. strip adjoining the site for the proposed new building, on which the power department building will be erected.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until July 19, for one 5-ton, one 3-ton, one 1-ton and three 1500-lb. motor trucks, complete with all appliances, etc., for the Department of Public Utilities, division of water. Specifications may be obtained on application to the office of the deputy commissioner of water, Room 211, City Hall.

COLUMBUS, OHIO.—The Columbus Railway, Power & Light Company is planning to erect a new transmission line to the southeast section of the city to supply electricity to the factories in that section. The cost of the lines is estimated at $80,000.

COSHOCTON, OHIO.—Work has begun on the construction of the new power house, to cost $25,000, for the Ohio Service Company, which is to take the place of the old building on North Fourth Street.

HOOKSTOWN, OHIO—The Hookstown Light Company, recently incorporated, to supply electrical service in Hookstown, will erect a transmission line from Rochester to Hookstown to supply electricity to towns in this vicinity. Electricity will be secured from the power plant on Cheat River. J. R. McNary and G. H. Pifer of Pittsburgh, Pa., are interested in the company.

OXFORD, OHIO—The City Council has authorized the trustees of the municipal electric-light plant to prepare plans and specifications for improvements and new machinery required for the municipal plant.

SANDUSKY, OHIO.—The City Commission has decided to install a six circuit repeater fire-alarm system to take the place of the present three-circuit system, to cost about $2,025.

SPRINGFIELD, OHIO.—The City Council has awarded the contract for installing globes and sockets for the new ornamental street-lighting system to the Gray Electric Company, at $9.65 per standard.

SULPHUR GROVE, OHIO.—Plans have been prepared by Schenck & Walker of Dayton, Ohio, architects, for the construction of a centralized school for Wayne Township at Sulphur Grove, which will have its own electric and heating plants. The cost is estimated at $30,000. Post office address, Sulphur Grove, R. F. D. from Osborne.

UPPER SANDUSKY, OHIO.—The Public Utilities Commission has authorized the Hardin-Wyandott Lighting Company of Kenton to issue $25,000 in bonds, to erect a transmission line between Kenton and Upper Sandusky.

BERRY, KY.—Mr. Bowman of Dry Ridge, Ky., it is reported, has applied to the Board of Trustees for a franchise to install an electric-light and power plant in Berry.

FORT THOMAS, KY.—The Altamount Hotel Company of Fort Thomas is preparing to let contracts for the construction of a power building on the Ohio River to serve the hotel and its surrounding buildings.

LANCASTER, KY.—The local electric-light plant has been purchased by the Light & Development of St. Louis, Mo. Ray Schooles is in charge of the plant.

ALTON, ILL.—The installation of new street-lighting units is under consideration by the city officials.

ALTON, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, Ill., until Aug. 1, for improvements at the Alton State Hospital, near Upper Alton, as follows: Light and power service wiring and outside lighting; two custodial buildings; separate bids will be received on the general work, heating, and electrical work. Plans and specifications for the above work may be obtained on application to James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago, Ill., upon deposit of $10.

PLEASANT HILL, ILL.—The Village Board is considering plans for the installation of an electric-light plant in Pleasant Hill. The plant will probably be operated as a private enterprise and later taken over by the village.

TEUTOPOLIS, ILL.—Plans are being considered by the Village Board for the installation of an electric-lighting system in Teutopolis.

WOODSTOCK, ILL.—Improvements to the municipal electric-lighting system are under consideration. It is proposed to issue bonds for the improvements or sell the plant to a private company.

BEAVER DAM, WIS.—The City Council is considering the installation of an ornamental street-lighting system in the business portion of the town.

CAMBRIA, WIS.—The Wisconsin Power, Light & Heat Company of Milwaukee is planning to install a street-lighting system in Cambria. Lamps of 60, 80, 100 and 250 cp. will be used.

PORTAGE, WIS.—The Wisconsin Power, Light & Heat Company is reported to have awarded general contract for construction of power station in Portage to Worden-Allen Company, 208 South La Salle Street, Chicago. Woodmansee & Davidson, 208 South La Salle Street, Chicago, Ill., are engineers.

RHINELANDER, WIS.—The power plant of the Rhinelander Light & Power Company at Hat Rapids is being entirely reconstructed, and a new switchboard installed.

WASHBURN, WIS.—The Washburn Electric Light & Power Company is in the market for either one three-phase or three single-phase voltage regulators. The company is installing a new street-lighting system, consisting of 58 posts mounted with 200-cp. Mazda lamps, to be completed in September.

FOLEY, MINN.—The St. Cloud Public Service Company has purchased the property of the Foley Electric Light & Power Company. It is expected that the local plant will be closed down and energy supplied from the transmission lines of the St. Cloud company.

GILBERT, MINN.—The Water and Light Department is contemplating the installation of a new street-lighting system in the business section of the city.

HASTINGS, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, Minn., until July 24 for materials for telephone, fire-alarm and watchman's clock systems for the Hastings State Asylum. Copies of plans and specifications may be obtained at the office of the Hastings State Asylum, Hastings, and at the office of Charles L. Pillsbury Company, engineers, St. Paul and Minneapolis.

RED WING, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, Minn., until July 24 for electric fixtures for State Training School, Red Wing, in accordance with plans and specifications, which may be seen at office of the superintendent of the State Training School, Red Wing, and at the office of Charles L. Pillsbury Company, engineers, St. Paul and Minneapolis.

EARLVILLE, IOWA—The Town Council has entered into a contract with the Iowa Railway & Light Company of Cedar Rapids to supply electricity to operate the municipal electric-light system.

MOUNT AYR, IOWA.—The Mount Ayr Light & Power Company is contemplating changing its system from direct to alternating current and to erect transmission lines to neighboring towns.

MUSCATINE, IOWA—The installation of an ornamental lighting system on several streets is under consideration by the lighting committee.

SEARSBORO, IOWA.—The Grinnell (Iowa) Electric & Heating Company has applied for a franchise to supply electricity for commercial purposes in Searsboro.

SIOUX RAPIDS, IOWA.—The Northern Iowa Gas & Electric Company is planning to change the distribution system in Sioux Rapids from 220 volts, direct current, to 220 volts alternating current. The local plant will be closed down and electricity will be transmitted from the Humboldt plant to supply the local service.

WADENA, IOWA—The Council is considering the question of granting C. Miller & Sons an electric-lighting franchise in Wadena.

ALTENBURG, MO.—The installation of a municipal electric-light plant in Altenburg is under consideration.

JAMESTOWN, N. D.—Plans have been prepared by A. J. O'Shea of Fargo, architect, for a new power house and smokestack for the Western Electric Company of Jamestown.

ONIDA, S. D.—A petition is being circulated asking that the City Council call an election to submit the proposal to issue bonds for the purchase of the plant of the Onida Electric Light & Power Company.

BEATRICE, NEB.—Preliminary plans have been submitted for the installation of an additional 350-kva. generating unit in the municipal electric-light plant.

FAIRBURY, NEB.—A stock company is being organized for the purpose of supplying electricity to the towns of Daykin, Western and Plymouth, providing that satisfactory franchises can be obtained. The company will be capitalized at $25,000. A. F. Kollman is interested.

GRAND ISLAND, NEB.—Plans have been completed for construction of a power and ice plant for the Soldier's and Sailors' Home, Grand Island, Neb. Leo Mathews, State House, Lincoln, is secretary board of control.

NEHAWKA, NEB.—The local electric-light plant, owned by E. M. Pollard, was recently destroyed by fire.

PLYMOUTH, NEB.—Local business men have organized a company with a capital stock of $20,000 for the purpose of supplying electricity in Plymouth. The company will be known as the Plymouth Light & Power Company and proposes to obtain energy to operate the system from Beatrice or Fairbury.

AUGUSTA, KAN.—Plans are being considered by the Wichita Natural Gas Company, the largest operator in the Augusta oil fields, to utilize electricity to operate its works. If the present plans are carried out the entire belt in Butler will soon be lighted by electricity. The company proposes to erect a large plant on the Varner farm, with sufficient output for pumping 1000 wells. It is proposed to use electric motors instead of gas engines for pumping purposes.

GARFIELD, KAN.—The Council is considering calling an election to vote on the proposal to issue $10,000 for the installation of an electric lighting system.

KANSAS CITY, KAN.—The Sulzberger & Sons Packing Company of Kansas City will soon purchase part of the electricity used at its plant from the municipal electric plant. The company has its own electric plant.

SCOTT CITY, KAN.—The Sugar Company of Scott City has recently acquired 22,000 acres of land, which is to be developed by irrigation, energy to be furnished by the central stations of the company. Extensions to transmission lines will be made.

## Southern States

BOONE, N. C.—Plans are being considered by the Boone Fork Lumber Company for the construction of a hydroelectric plant at Boone's Fork Falls. David R. Shearer is electrical engineer for the company.

ATHENS, GA.—A bill has been introduced in the State Legislature asking for an appropriation of $40,000 for construction of an electric-light and power plant at the University of Georgia at Athens, and also for $50,000 for erection of building and dormitory.

CORDELLE, GA.—At an election to be held Aug. 3 the proposal to issue $50,000 in bonds for the installation of a municipal electric-light and power plant will be submitted to the voters.

MACON, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 3 for plumbing, heating and lighting repairs at the United States post office and court house at Macon, Ga. For details see proposal columns.

SAVANNAH, GA.—The City Council has approved two resolutions authorizing committees appointed to make investigations relative to the establishment of a municipal

electric-light plant and the construction of a belt line railway to furnish the manufacturers of the city with better shipping facilities.

PENSACOLA, FLA.—The State Legislature has passed a bill authorizing George H. Hervey of Pensacola to construct and operate an electric railway on Fort Barrancas and Fort McRae military reservations.

TAMPA, FLA.—Plans are being considered, it is reported, for the construction of an electric railway from St. Petersburg to Tampa, a distance of about 20 miles. George Gandy, Sr., and Lewis B. Brown of St. Petersburg are interested.

NASHVILLE, TENN.—An ordinance is being considered by the City Council providing for a bond issue at $1,500,000 for the erection of a municipal electric-light plant.

FAIRHOPE, ALA.—The installation of a municipal electric-light plant in Fairhope is under consideration.

EDWARDS, MISS.—Plans are being prepared by X. A. Kramer of Magnolia, consulting engineer, for the installation of a municipal electric-light plant in Edwards.

GEORGETOWN, MISS.—Plans are being prepared by X. A. Kramer, consulting engineer of Magnolia, Miss., for the construction of a municipal electric-light plant and water-works system.

LAKE CHARLES, LA.—Plans have been prepared for the installation of a small electric plant to operate the Calcasieu River bridge when completed. The cost is estimated at $2,600. For further information address F. H. Franklin, Lake Charles.

WHITE CASTLE, LA.—The installation of an electric-light plant and water-works system in White Castle is under consideration.

CANADIAN, OKLA.—At an election held recently the proposal to grant a franchise for the installation of an electric-light plant in Canadian was carried.

DEWAR, OKLA.—The Henryetta (Okla.) Electric Light Company is contemplating installing an electric-lighting system in Dewar.

DURANT, OKLA.—The City Council has adopted a resolution to sell the municipal electric lighting plant of Durant (Okla.) to the Durant Ice & Light Company, at $18,500. The municipal plant has been closed down for some time.

GOLTRY, OKLA.—Bids will be received until July 20 for construction of an electric-light plant for the city of Goltry. The Benham Engineering Company, Colcord Building, Oklahoma City, has charge of the engineering work.

MILBURN, OKLA.—At an election held recently the proposal to issue $9,000 in bonds for the installation of an electric-lighting system in Milburn was defeated.

PECKHAM, OKLA.—The Oil Fields Short Line Electric Railway of Oklahoma City, recently incorporated with a capital stock of $200,000, contemplates the construction of an electric railway from Peckham to Braman, a distance of 16 miles. J. A. Frates, Sr., and J. H. Grant are interested in the company.

ALTO, TEX.—The property of the Alto Light & Power Company, it is reported, has been purchased by the Parsons Gold Mining & Milling Company. The new owners, it is understood, will make improvements to the plant and install new machinery.

HALLETSVILLE, TEX.—An oil-burning engine will be installed at the municipal electric-light plant, at a cost of about $7,700.

JACKSONVILLE, TEX.—The Interstate Electric Corporation has purchased the electric-light plant and ice factory of the Jacksonville Ice & Electric Company. Improvements, it is understood, will be made to the property.

PARIS, TEX.—The Southwestern Telephone Company is planning to erect a new exchange here soon to replace the building recently destroyed by fire.

PLAINVIEW, TEX.—The Texas Utilities Company is planning to install a 500-hp. oil-burning engine at its local plant and extensions to its transmission system.

SWEETWATER, TEX.—Bids will be received for the construction of a fireproof court house, including plumbing, heating and wiring. C. H. Page & Brothers of Austin are architects. For further information address John H. Cochran, county judge.

WHARTON, TEX.—The Texas Southern Electric Company of Victoria has awarded contract to J. T. Williams for the erection of an addition to its power house in Wharton. Extensive improvements are contemplated to the plant here.

## Pacific States

EVERETT, WASH.—Louis Lesh, city clerk, has filed nine applications for water rights in the Sultan River, the water to be diverted from nine separate points to be used for development of electrical energy for transmission to Everett, and for other purposes.

OTHELLO, WASH.—Plans are being considered by O. G. Vroom and Dr. H. J. Coventry of Othello for the installation of an electric-light plant in the basement of the Hotel Hibbard to supply electricity for lighting the hotel and adjacent business houses in Othello. It is proposed to install a plant with sufficient output to light the streets and residences of the entire town.

SOUTH BEND, WASH.—Preparations are being made by the Willapa Power Company for the construction of a power dam and 700 ft. of pipe line on the South Fork River. A fall of 45 ft. will be secured, which will develop more than twice the power needed in South Bend at the present time.

SPOKANE, WASH.—The school board of Spokane has asked both the Washington Water Power Company and the Spokane Heat, Light & Power Company to submit bids for furnishing electricity separately for each school in the city.

SPOKANE, WASH.—The contract for the construction of a steam heating and electric power plant for the Spokane Heat, Light & Power Company, successor to the Merchants' Central Heating Company, to Porter Brothers of Spokane, at $88,000. The equipment will include ten 700-hp. boilers and three turbo-generator units with a total capacity of 6000 kw. Contracts have been placed for equipment. E. Darrow is manager and Harry A. Flood is president of the company.

SPOKANE, WASH. — The Spokane (Wash.) Valley Power Company has petitioned the City Council for a franchise to supply electricity for lamps and motors and steam heating in the city of Spokane. Under the plan of the power development announced by the company, the Spokane River banks will be overflowed for six miles, extending from the power site at the old smelter to a point midway between Natatorium and Downriver Parks. At the Downriver Park bridge the river level will be raised 4 ft. above the low water stage, creating a lake of still water. It is estimated that the river level can be raised 80 ft. by a dam at the north end of the rock gorge at the smelter. H. S. Stoolfire is secretary of the company.

VANCOUVER, WASH.—The Portland Railway, Light & Power Company, it is reported, is planning to construct a large transformer station near the interstate bridge, across the Columbia River, between Vancouver, Wash., and Portland, Ore.

PORTLAND, ORE.—The contract for electric wiring in the Public Auditorium has been awarded to F. A. Bauman of Portland at $27,895.

SEASIDE, ORE.—The City Council has granted the Pacific Power & Light Company a 25-year extension to its electric franchise in Seaside. The company has signed a contract for lighting the streets of the city which will effect a saving of $1,000 per annum. Work will begin at once on the erection of a high-tension transmission line from Astoria to Seaside, and other extensive changes in the equipment of the Seaside plant will be made. Floyd J. Keys is local manager.

FRESNO, CAL.—In the sundry civil bill which recently passed the House of Representatives in Washington, $250,000 was appropriated for improvements in the Yosemite, of which $150,000 will be used for the construction of a hydroelectric power plant for the use and benefit of the park.

HAYWARD, CAL.—The Chamber of Commerce has appointed a committee to confer with the City Trustees regarding the installation of an electrolier lighting system on the principal streets of the city.

KENNETT, CAL.—The United States Smelting & Refining Company is planning to install an electrolytic zinc plant at the Mammoth Copper Company (a subsidiary) works at Kennett, at a cost of about $350,000.

MERCED, CAL.—The City Trustees have appointed a committee to canvass the property owners in regard to the proposed electrolier lighting system in the business district.

SAN LEANDRO, CAL.—The installation of a new street-lighting system, consisting of electroliers mounted with lamps of 250 cp. will be recommended by the Town Board.

POCATELLO, IDAHO.—Arrangements are being made to begin work on a preliminary survey for the erection of an electric transmission line for the Utah Power & Light Company of Salt Lake City from the Utah line to Pocatello.

ROCKLAND, IDAHO.—Application has been made by J. E. Marsh and H. B. Logan of Rockland to the Public Service Commission for a certificate of necessity for the construction of a power plant and transmission lines to supply electricity in Rockland and four adjoining towns.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company is erecting an electric transmission line between Springville and Mohrland, at a cost of about $500,000. Negotiations, it is reported, are under way relative to equipping the Denver & Rio Grande Railroad for electrical operation.

KINGMAN, ARIZ.—The Desert Power & Water Company of Kingman is in the market for a 3000-hp. turbo-generator set, condensers and other equipment. The company will install without delay Edge Moor boilers of 2000 hp. R. W. Wilde is vice-president.

WICKENBURG, ARIZ.—Bonds to the amount of $12,000 have been voted to establish a municipal electric-light plant in Wickenburg.

PUEBLO, COL.—The City Commissioners have adopted a resolution asking the Arkansas Railway, Light & Power Company to replace the arc lamps now in use with new lamps. Provision has also been made for the installation of additional lamps.

LORDSBURG, N. M.—The Eighty-five Mining Company has placed orders for machinery, duplicating the present equipment of its electric power plant, which will increase the output by 450 hp. A. J. Interrieden is manager.

MOGOLLON, N. M.—Surveys have been completed by Earl C. Cleaveland for a proposed hydroelectric plant to be built in this section to supply power to operate the machinery in the mines in this district. About 1500 hp. will be developed.

## Canada

PEACE RIVER, ALTA.—Plans have been prepared by W. D. Cromarty, University of Alberta, Edmonton, for the installation of an electric generating plant. For further information address W. D. Cromarty, secretary to the department of public works, Ottawa, Ont.

SAULT STE. MARIE, ONT.—Tenders will be received by H. F. McNaughten, secretary of public works department, Department of Public Works, Ottawa, until July 21, for construction of court house at Sault Ste. Marie, separate tenders to be submitted for heating and ventilating and plumbing and electric wiring. Plans and specifications may be seen at the office of the sheriff, Sault Ste. Marie, and at the above department.

## Miscellaneous

PANAMA.—Bids will be received at the office of the assistant purchasing agent, the Panama Canal, 24 State Street, New York, N. Y., until Aug. 23, for the purchase of engines and generators, steam boilers, air compressors, condenser, feed water heaters, steam pump and air receivers, offered for sale by the Panama Canal. For details see proposal columns.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 31 for furnishing steel car wheels, journal bearings, steel castings, steel cable, chains, steel pipe, pipe fittings, air compressor, panel boards, electric wire, flexible conduit, steel conduit, electrical attachments, solder, comptometers, etc. Blanks and general information relating to this circular (No. 1062) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 17, for furnishing roofing steel, steel bars, ammonia pipe, copper nails, sheet copper, magnet wire, pothead wire, electrolite, light fixtures, ceiling fixtures, electric fixtures, lantern fixtures, panel board and box, electric fuses, etc., for Ancon Hospital lavatory. Blanks and general information relating to this circular (No. 1061) may be obtained at the above office and at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,189,224. Railway Safe-Running Device; A. R. Angus, Spit Road Mosman, New South Wales, Australia. App. filed Jan. 18, 1911. Contact rails on trackway.

1,189,225. Railway Safe-Running Device; A. R. Angus, Spit Road Mosman, New South Wales, Australia. App. filed Jan. 18, 1911. Has a reversing track contact.

1,189,226. Railway Safe-Running Device; A. R. Angus, Spit Road Mosman, New South Wales, Australia. App. filed Jan. 18, 1911. Arrangement of contacts.

1,189,228. Electrical Protective Device; A. H. Bakken, Wilkinsburg, Pa. App. filed March 24, 1914. For resetting under-potential trip.

1,189,234. Electric Measuring Instrument; H. W. Brown, Wilkinsburg, Pa. App. filed Oct. 8, 1910. Of the motor type.

1,189,235. Bond; J. R. Brown, Mansfield, Ohio. App. filed April 6, 1914. Protector sleeve surrounds stranded conductor.

1,189,236. Duplex Telegraph System; W M. Bruce, Jr., Springfield, Ohio. App. filed Nov. 7, 1913. Uses quick and slow relays.

1,189,240. Electrical Relay; A. W. Copley, Wilkinsburg, Pa. App. filed July 24, 1912. For circuit breakers.

1,189,260. Engine Starter; C. L. Kennedy, South Braintree, Mass. App. filed Sept. 25, 1912. Self-regulating when running as a dynamo.

1,189,265. Electrode; I. Ladoff, Wilkinsburg, Pa. App. filed July 19, 1913. Titanite, material sulphur fluoride, barium as agent.

1,189,272. Lightning Arrester; W. McK. McClintock, St. Paul, Minn. App. filed Aug. 6, 1909. Block of carborundum.

1,189,274. Circuit Interrupter; H. F. MacDonald, Wilkinsburg, Pa. App. filed Feb. 15, 1912. Has auxiliary power device.

1,189,276. Circuit Interrupter; J. N. Mahoney and W. M. Austin, Wilkinsburg, Pa. App. filed Sept. 28, 1912. Has wiping carbon terminals.

1,189,290. Control System; C. Renshaw, Edgewood Park, Pa. App. filed June 9, 1914. For electric railway. motors.

1,189,292. Control System; L. G. Riley, Wilkinsburg, Pa. App. filed May 11, 1914. "Bridging" type of transition from series to parallel.

1,189,296. Variable Speed Motor; H. M. Scheibe, Wilkinsburg, Pa. App. filed June 5, 1913. Single-phase fan motor.

1,189,314. Relay; C. R. Underhill, New Haven, Conn. App. filed Aug. 4, 1904. For wireless.

1,189,316. Circuit Controlling Instrument; E. W. Vogel, Oak Park, Ill. App. filed June 25, 1914. Operated by deflection of railway rail.

1,189,317. Inductive Telephone Installation; H. Von Kramer, Erdington, Birmingham, England. App. filed Nov. 4, 1910. For moving trains.

1,189,326. Impulse Starter; P. A. Wiley, Kokomo, Ind. App. filed Jan. 19, 1916. For giving quick starting flow to magnetos.

1,189,340. Locomotive or Car; A. F. Batchelder, Schenectady, N. Y. App. filed June 9, 1915. Swivel truck to relieve side pressure of electric locomotives.

1,189,341. Electric Locomotive; A. F. Batchelder, Schenectady, N. Y. App. filed March 16, 1916. Cab construction removing danger of contact with live parts.

1,189,356. Electrical Furnace; P. Eyermann, Witkowitz, Austria-Hungary. App. filed Dec. 5, 1912. Has tiltable crucible.

1,189,364. Automatic Telephone Switch; A. E. Keith, Chicago, Ill. App. filed Nov. 15, 1911. Uniform motion controlled by push buttons.

1,189,370. Gas-Igniting System; W. Lowman, Silver Creek, Neb. App. filed July 19, 1915. Has an electrically opened valve.

1,189,374. Ignition Dynamo; C. T. Mason, Sumter, S. C. App. filed March 15, 1915. For two-cylinder engines.

1,189,392. Circuit Interrupter; C. Aalborg and T. S. Pukerud, Wilkinsburg, Pa. App. filed July 24, 1911. Main and arcing terminals mounted on separate arms.

1,189,400. Electric Regulator for Incubators; W. W. Smith, Hawthorne, Cal. Filed March 9, 1915. For controlling the action of hot air currents.

1,189,409. Automatic Motor Protecting Switch; J. A. Van Alstyne, Sacramento, Cal. App. filed June 1, 1915. Switch automatically opened and placed on non-latchable relation.

## *Record of Electrical Patents*

**Notes on United States Patents issued July 4, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.**

1,189,411. Telephone Transmission System Wherein Reinforcing-Repeaters Are Employed; A. S. J. Van Kesteren, Vlissingen, Netherlands. App. filed Dec. 19, 1913. Unnecessary to balance portions of lines or to use reversing switches.

1,189,419. Controlling Means for Electric Signs; W. Bach, Atlantic City, N. J. App. filed Dec. 30, 1915. Series of flexibly connected letter flanges.

1,189,435. Electrical Connection; W. S. Edmands, Boston, Mass. App. filed June 11, 1915. For connecting a series of desks or the like.

1,189,458. Telephone Exchange System; A. E. Lundell, New York, N. Y. App. filed May 10, 1915. Simplified connector circuit.

1,189,490. Telephone Attachment; E. Snaders, New York, N. Y. App. filed Dec. 19, 1914. Phone can be used without removing receiver from the hook.

1,189,520. Lighting Fixture; H. C. Adam, St. Louis, Mo. App. filed Sept. 12, 1915. For fusing shield or bowl.

1,189,525. Telephone System; G. Babcock, Rochester, N. Y. App. filed July 5, 1910. Can determine when the line is busy without actuating message meter.

1,189,530. Electric Switch; H. H. Berry, London, and W. J. Markham, Birmingham, England. App. filed Nov. 2, 1914. Special toggle construction.

1,189,532. Prod Pole; W. P. Bishop, Edna, Tex. App. filed Oct. 25, 1915. Has terminals for shocking animals.

1,189,533. Portable Electric-Lamp Stand; A. Bouchery, New York, N. Y. App. filed Jan. 11, 1915. Can be clamped and supported in various positions.

1,189,546. Telegraphic Sending Machine; P. Dinger, Cleveland, Ohio. App. filed April 15, 1909. Avoids grounding frame of machine.

1,189,565. Lightning Conductor; D. W. Hartsaw, Bristow, Okla. App. filed Aug. 19, 1915. For protecting oil and gas tanks.

1,189,581. Method of and Apparatus for Electric Welding of Metallic Plates; C. H. Kicklighter, Atlanta, Ga. App. filed Oct. 15, 1913. Opposes flow of magnetic flux which causes self-inductance and for eliminating eddy currents.

1,189,582. Method of Electric Welding; C. H. Kicklighter, Atlanta, Ga. App. filed Nov. 10, 1913. Welding metals into cylinders.

1,189,583. Method of Electric Riveting; C. H. Kicklighter, Atlanta, Ga. App. filed Nov. 28, 1913. Rivets heated electrically and mechanical pressure forms the bolt heads.

1,189,584. Apparatus for and Method of Electric Fastening of Metals; C. H. Kicklighter, Atlanta, Ga. App. filed April 5, 1915. Series of welds simultaneously made by three-phase system.

1,189,630. Self-Winding Clock; F. M. Schmidt, Brooklyn, N. Y. App. filed Feb. 27, 1915. Automatic make-and-break device.

1,189,657. Attendant's Signaling System; F. Brinkmann, Hanover, Germany. App. filed July 31, 1914. Particularly for large hotels.

1,189,664. Neon Tube; G. Claude, Boulogne-Sur-Seine, France. App. filed Feb. 12, 1915. Displaces atmosphere of tube toward the purifying chambers.

1,189,685. Switch; M. Guett, Hartford, Conn. App. filed Nov. 21, 1913. Double push-button switch.

1,189,703. Alternating-Current Motor; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 26, 1910. Commutator with 50 per cent speed variation.

1,189,725. Method and Apparatus for Producing High Temperatures; E. F. Northrup, Princeton Borough, N. J. App. filed Oct. 8, 1915. Carbon resistor confined in space to or from which gases cannot readily pass (47 claims).

1,189,728. Telephone Repeater; A. H. Olsson and H. B. M. Pleijel, Stockholm, Sweden. App. filed Nov. 28, 1914. Has two induction coils, one working with speech currents and other with calling currents.

1,189,735. Dental Injector and Extractor; J. C. Quintin, La Manda Park, Cal. App. filed Aug. 26, 1915. Adapted to be connected with compressed air and electrical supply in model office building.

1,189,738. Device for the Rectification of Alternating Electric Currents; O. W. Richardson, Princeton, N. J. App. filed June 5, 1913. Utilizes incandescent body.

1,189,755. Portable Electric Light; H. R. Van Deventer, Sumter, S. C. App. filed May 17, 1915. Generator driven by clock work.

1,189,768. System of Electrical Distribution; J. L. Woodredge, Philadelphia, Pa. App. filed Nov. 26, 1913. Eliminates momentary interruptions for starting up synchronous apparatus.

1,189,771. Electrical Control Apparatus; C. Ambruster, Roslyn, Pa. App. filed Sept. 26, 1913. Master switch.

1,189,784. Trolley-Wire Hanger; G. H. Bolus, Mansfield, Ohio. Filed Oct. 22, 1914. For attachment to span wires.

1,189,791. Apparatus for and Method of Exciting Electric Oscillations; E. L. Chaffee, Somerville, Mass. App. filed Nov. 4, 1911. Uniform and regular oscillation for small damping and large train frequency.

1,189,794. Electric Regulation; J. L. Creveling, New York, N. Y. App. filed Feb. 26, 1912. For charging storage batteries.

1,189,795. Mechanical Horn; G. C. Dean, Bronxville, New York. App. filed July 22, 1915. Series of balls thrust against diaphragm.

1,189,836. Telephone System; E. Land, Grand Rapids, Mich. App. filed Jan. 30, 1905. Semi-automatic of improved speed (eighty-one claims).

1,189,847. Locomotive-Wiring Fitting; J. Lofgren, Chicago, Ill. App. filed Dec. 3, 1914. For connecting engine and cab-carried wiring.

1,189,848. Meter Panelboard; J. P. McGrady, Worcester, Mass. App. filed Dec. 21, 1914. Meters for different room can be connected or disconnected by manipulation of plugs.

1,189,855. Meter-Testing Device; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Dec. 2, 1915. Single gang plug co-operates with pivoted levers of service switch.

1,189,856. Method of Localizing the Burr at Electrical Butt or Edge Welded Joints; T. E. Murray, New York, N. Y. App. filed Feb. 18, 1916. Flanges over ends and presses them together with welding curent.

1,189,862. Ringing-Current Interrupter; H. F. Obergfell, Chicago, Ill. App. filed May 22, 1912. Supplies ringing current to only one section of the circuit at a time.

1,189,869. Liquid Gage; F. I. Remy, B. P. Remy and A. Berger, Anderson, Ind. App. filed Nov. 13, 1914. Float varies the current going to the gage.

1,189,870. Circuit Make-and-Break Device; L. T. Rhoades, Mount Clare, Pa. App. filed Oct. 23, 1915. Contacts apart except at intervals spark is being produced.

1,189,881. Wireless Telegraphy; F. C. Simpson, Seattle, Wash. App. filed April 23, 1913. Employs adjustable reed vibrator elements.

1,189,883. Apparatus for Limiting the Traction of an Electromagnet; I. M. Stein, Long Branch, N. J. App. filed Nov. 17, 1915. Concentrates magnet cores and confines excess flux so it can exert no armature attraction.

1,189,887. Method for Controlling the Efficiency of Mercury Rectifiers; W. Tschudy, Lynn, Mass. App. filed April 15, 1913. Selects a particular vapor pressure on which to operate.

1,189,891. Electrical Relay; H. G. Webster, Chicago, Ill. App. filed April 3, 1914. Increased magnetic efficiency for telephone work.

1,189,895. Overhead Trolley System; Samuel Wilson, Chicago, Ill. App. filed May 6, 1915. Trolley wheel does not leave wire at line intersections.

1,189,900. Switch; V. G. Apple, Dayton, Ohio. App. filed Aug. 17, 1914. Connects lamps in series for dimming.

1,189,931. Resistance Box and the Like; A. Frohne, Chicago, Ill. App. filed Aug. 31, 1914. Special mounting of coils and other parts.